ELECTRICAL REVIEW

and WESTERN ELECTRICIAN with which is consolidated ELECTROCRAFT

VOL. LXVI, No. 7. CHICAGO, SATURDAY, FEBRUARY 13, 1915. ISSUED WEEKLY

COMPRISING

ELECTRICAL REVIEW WESTERN ELECTRICIAN ELECTROCRAFT

ELECTRICAL REVIEW PUBLISHING COMPANY, INC.

608 SOUTH DEARBORN STREET

CHICAGO

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One Year, United States $3.00
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Single Copy, 10 cents. Back one month, each.. .25

Entered as second-class matter, November 7, 1908, at the Post Office at Chicago, Ill., under the Act of March 3, 1879.

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BRITISH EXPERIENCE WITH CONCENTRIC WIRING.

The proposition to adopt in the United States the concentric system of wiring which has found application in European countries, or at least to make it permissible in territory governed by the National Electrical Code, had the effect, especially upon manufacturers of electrical supplies and the contractors who install the same, of a bomb thrown in their midst. Fears were at once expressed that business enterprises which have been built up upon the present installation rules would be ruined. That these fears have little foundation is evidenced by the experience already had in England with the concentric system, as the views of prominent English manufacturers, contractors and electrical engineers published in the present and the last issues demonstrate. This testimony shows that the permissible use of concentric wiring in a large part of England has not decreased the sale of steel conduit, which remains the recognized standard for first-class wiring in new buildings in that country and is, in fact, growing in favor, as its introduction there was somewhat later than in this country. The manufacturers of conduit have felt no bad results upon their business from the introduction of concentric cable and only one of them expresses the opinion that the latter will ever supplant the more rugged method of installation generally.

It should, of course, be borne in mind in this connection that the use of the concentric wiring system is not universally permitted in England, but is subject to certain restrictions. It is permissible in isolated plants and has found its principal application there. Where energy is supplied from a central station and the supply mains are not grounded, the use of the concentric method is permitted only where an individual transformer is utilized to insulate the local wiring from the supply system. This condition is fairly general in England and greatly restricts its use. Moreover, many municipalities do not permit the use of the system at all.

Considering the fact that in this country the central stations are taking a leading part in advocating this cheap form of wiring, whereas contractors seem rather generally opposed to it, it is curious to note that in England all of the central-station men quoted are opposed to this system, whereas one of the greatest enthusiasts for it is a prominent contractor who is president of the Electrical Contractors' Association. While this contractor prefers the method to any other form of wiring, partly because estimates can be more accurately prepared for it, it is to be noted that another prominent contractor does not use it at all and appar-

ently his business has not suffered in consequence.

It should be noted also that a number of central-station representatives in England seem to prefer a form of sheathed cable, corresponding somewhat to the duplex flexible armored conductor quite generally used in the United States, to the concentric system.

Another point to be noted in this connection is that the conduit in general use in England is not nearly so heavy as that prescribed by the rules in this country and that consequently the difference in cost between the standard method and the cheaper concentric wiring is not so great as would be the case here. This may in part explain why conduit work has not been more largely displaced in English practice. Such conduit work as has been displaced is principally of a type that is not permitted at all in this country; that is, conduit work in which the separate lengths are not screwed together, but are held in position by what is known as "slip tubing," which permits very rapid work and lower labor costs. However, the principal use which has been found for the concentric wiring in England, outside of isolated plants, seems to be in wiring houses already built, where surface wiring seems essential, and where the concentric method is used as much on account of its appearance as on account of its cost. There need be little fear in this country that this method would ever displace what is now standard work under any other conditions than these. Manufacturers and contractors may dispel their fears upon this point. The real question which should be decisive in this matter is as to the safety of the concentric system and whether it will in time lead to trouble which would make its installation undesirable. Is there any increased hazard introduced by this method? Is there any other method which will meet the same requirements without introducing any new hazard?

MUNICIPAL ENGINEERING.

We have more than once called attention in these columns to the importance of the engineer in certain features of governmental work and particularly in the conduct of municipalities. It is gratifying to note that the new charter of the city of St. Louis, Mo., adopted last year, recognizes the importance of engineering work in municipal government and provides for the active participation of engineers in certain parts of the city management.

All engineering and construction work undertaken by the city is put under the supervision and control of a Board of Public Service, consisting of five members, three of whom, including the president, must be engineers of at least ten years' experience. The members of this board are appointed by the mayor for a term of four years and are subject to removal only for cause. Each director is given charge of a particular department under the general control of the board.

This action of St. Louis is decidedly commendable and should serve as a model for other municipalities when revising their city government. St. Louis is a leader in this regard not only in the present instance, but it has been customary there in the past to have public works controlled by a board containing a majority of engineers, although it has not heretofore been a charter requirement.

REPRODUCTION COST VERSUS INITIAL COST.

In the valuation of public utilities for the purpose of both rate-making and purchase much emphasis has of late been placed upon the element of the cost of reproduction, in connection with which, of course, depreciation is taken into account. In many cases, owing to the absence of necessary records, this has been the only practicable method of arriving at the value of a given plant. By some it is maintained that this is the best method of appraisal even when other data are available. The argument for this is stronger in the case of valuation for purchase than in the case of valuation for rate-making, and in the latter case there are many authorities who maintain that original cost is the proper basis for consideration. Court decisions have not yet laid down any very definite principles as a guide in valuation cases, the more important decisions indicating that all methods of appraisal should be given due consideration and the weight given to any one of them should be determined according to the circumstances of each particular case.

In Massachusetts the Public Service Commission has, however, expressed itself very decidedly upon this question, pointing out that the law of that state indicates that it is the original cost of a utility plant which should govern in any determination of rates and of the annual return which is to be permitted to the owners. This question was rather fully discussed in the decision handed down last October when approving an increase in the rates of the Middlesex and Boston Street Railway Company. The opinion in that case pointed out that while the method of reproduction cost favors the utility company during a period of rising prices, it would bear heavily upon the investor in a period of low prices, such as the country went through in 1897, and that in the long run both investor and consumer will receive greater justice upon a basis of original cost. For instance, with the low prices prevailing for copper during 1914, great injustice might be done a telephone company in the appraisal of its lines upon the reproduction basis and, moreover, that method would give greatly varying results from year to year.

The basis of original cost makes rates depend upon the actual investment of the owner and consequently does justice to him in spite of any variation in the cost of labor and material from time to time. To quote the words of the commission: "It is entirely clear that in the long run the rate-paying public as well as the investing public will be the best served if regulation makes as its fundamentally guiding principle an attempt to protect investments honestly and prudently made and wisely managed. Any other theory involves essential injustice, tends to make development of our public util-

ity companies a speculation and not an investment, operates as a premium upon various kinds of fraud, invites into the public service undesirable manipulators instead of sound, level-headed business managers; makes every rate case an almost interminable and labyrinthine inquiry into values with endless conflicts between so-called experts."

INCREASING REVENUE FROM OLD CUSTOMERS.

A story is told of a young business man, sales manager of a manufacturing company, falling heir to a controlling interest in a progressive utility concern and assuming management of the company, which served both gas and electric consumers. Being thoroughly familiar with all phases of sales work, although without experience in public-utility operation, the new executive naturally turned to the commercial department as the first point at which to undertake to master details and give directions. He found to his surprise that common selling practice among public service companies is very different from the accepted standard in the mercantile and manufacturing world. He found that the gas and electric salesman is employed to secure new business, which means new customers. Yet in every other business the chief function of the outside salesman is to keep in touch with regular customers, to sell them more and more and to aid and stimulate them to the development of a greater market for the line.

Believing that these principles were applicable to public-utility practice, the new manager, so the story continues, established new rules for the commercial department. He maintained that there was greater profit in inducing a consumer to throw out his coal range and cook with gas entirely than in installing one more range beside another coal equipment; or in securing constant use of appliances already in the home than in selling other appliances in other homes; more profit in maintaining sales to present customers, than in ceaselessly striving for other customers at greater cost. The company took the position that every customer represents an investment that should pay its revenue; it should be developed to its greatest earning power.

In this case the experiment worked. The market opportunity automatically resolved itself into a prospect of both consumers and non-consumers. The consumer offered the most alluring promise, because a sale to him exacted no investment in connection cost. The monthly business statements were made up to show the volume of the sales and the profit rather than new customers and their estimated consumption.

There are undoubtedly many companies that have realized the importance of increasing the revenue from existing customers, but there was never a time when this sort of sales effort appeared to be more necessary or more pertinent than at present when the tendency throughout the country is to minimize expenditures.

There are many central-station power customers who have a modern system of motor drive and an antiquated lighting installation that could be modernized if the proper sales effort was extended; other manufacturers who have never been told of the convenience or economy of electric glue pots, or electric forge blowers, or chocolate warmers, or ozone machines, etc.

In the residence field there is even a greater opportunity to increase the revenue from existing customers. There is hardly a company engaged in central-station work that has not in some way promoted the sale of domestic appliances, but how many companies have ever encouraged the use of these appliances, once the sale is made? It would be interesting to know how many appliances are in disuse because of a needed new cord or a minor repair that is neglected; or how many sockets are out of order, thus preventing the consumption of current that might mean a profit on the installation. Where such canvass of conditions has been made, the results have been astonishing. It has been the experience of one representative company that 90 per cent of the appliances brought in for repair needed only a new cord or a new terminal and a large percentage of the sockets out of order need only a new screw, or some other minor repair that requires only a few minutes to adjust. Yet only an inconsiderable percentage of such cases come to the attention of the company in the usual course of events.

With a full realization of this situation, one progressive company has employed a man who will be provided with a small trouble kit and make a house-to-house canvass of the customers for the purpose of repairing irons, toasters, and other appliances, also sockets and switches out of order. He will also be provided with exchange tickets which are to be given to a customer in case an appliance is found to be beyond repair. The ticket together with the old appliance will entitle the customer to a new device at cost.

It is needless to say that this plan must necessarily be profitable to the company. In addition to the repair work the representative can also suggest the use of additional appliances, larger lamps, etc., thus further increasing revenue from old customers; but what is perhaps of more importance is the impression left with the customer that the company is striving to furnish good service.

There is always a danger of burdening a customer with too many current-consuming devices and increasing his bill to a point where he feels he can no longer afford electric service and judgment must be exercised in avoiding this condition. However, there is greater loss from an underdevelopment and it seems as if more attention could well be given the more intensive cultivation of central-station business with the view to increasing the volume of business without increasing the investment in service connections.

Selenium Discussed at Joint Meeting of Electric Club and Commonwealth Edison Section, N. E. L. A.

The meeting of the Electric Club of Chicago, on February 4, was held jointly with the Commonwealth Edison Section of the National Electric Light Association and over 400 members and guests of the two organizations were in attendance. B. F. Meissner presented a paper entitled, "Selenium, Its Applications and Possibilities in Electrotechnics," and conducted a number of unique demonstrations based on the effect of light rays on a selenium cell. A small box containing a propelling motor and arranged to be started upon the operation of a relay was made to more forward or backward when light rays from a hand flash light were directed upon two selenium cells contained in the box, this releasing the relay which in turn started the motor. Each of the cells was behind a lens and directing the light on either lens would cause the motor to be started. Another relay was arranged to control by means of solenoids, a steering post thus permitting the box to follow the light in any directions. The direction of turning depended upon the amount of light directed to either lens.

Another relay arranged on a table was made to operate a lamp, start an induction motor, ring a bell, etc., by directing light rays from a projector on a selenium cell which controlled the relay.

Preceding the demonstrations, Mr. Meissner discussed several applications of the selenium cell, these including operating a gas buoy, registering heart throbs, controlling a moving torpedo, etc.

Boston Electrical Men Get-Together Luncheon.

An innovation in electrical men's gatherings has been inaugurated in Boston, Mass., where monthly noon gatherings at luncheon will be held during the winter and spring. The first occurred on February 4, when 140 met at the New American House at a 50-cent luncheon. The sponsors are the New England Section, N. E. L. A., the Boston Electric Motor Car Club, the New England Committee, Society for Electrical Development, the Jovians and the Electric Vehicle Association.

Louis D. Gibbs presided and pumped enthusiasm into the gathering. John D. Cole, chairman of the Industrial Development Board of Boston, spoke on the uses of electric transportation in booming the Hub. He advocated a trolley belt line to connect the freight depots, wharves, factories and business houses and give ready freight transfer by night, over traction lines. He cited New Orleans, where freight is transferred to any point in the city in 4.5 hours, at $2.00 a carload, whereas in Boston the cost is $14.00.

Mr. Gibbs pointed out the present use of two electric trucks by one of the railroad companies, for transferring freight between cars in the yard, with a net saving of $20 per day over switching costs otherwise entailed.

George D. Berry, of the Boston Auto Show management, stated that this year's show will be the largest ever held, combining the truck and pleasure car division in one event. Many electrics will be exhibited among the one hundred models shown.

The March luncheon will have for its subject "How to Get Business."

Chicago Jovian League.

Walter D. Moody, of the Chicago Plan Commission, delivered a very interesting illustrated address before the Chicago Jovian League on February 8, on the subject of "The Plan of Chicago." He showed many views of European cities, illustrating the progress that has been and is being made in city planning. Up to the present time little or nothing has been done to relieve the chaotic traffic conditions or improve the health conditions of Chicago, although a comprehensive, practical plan has been perfected and proposed by the Chicago Plan Commission. This plan was discussed rather fully, particularly as it applies to improving the lake front and rivers. This, the initial work of the plan, will be started as soon as the necessary Government permits are granted. Mr. Moody, throughout his address, showed the relation between civic and commercial progress.

Victor H. Tousley, president of the League, announced that an effort is being made to schedule a rejuvenation during the forthcoming convention of the Electrical Supply Jobbers' Association in Chicago on March 17.

Program for New York Electrical Society Meeting.

At the meeting of the New York Electrical Society on February 17, Putnam A. Bates, electrical engineer of the New York fire department, will deliver an illustrated lecture on "The Fire-Alarm System of New York City" explaining the steps now being taken for the improvement of the system. Following this a demonstration will be given of lighting for photographic studios, covering both still and motion-picture work and employing arc, incandescent and mercury-vapor lamps. It is expected that several executives of prominent motion-picture concerns will attend.

Philadelphia Jovians Hold Record Luncheon.

What is probably the largest attendance in the history of Jovian luncheons was present at the weekly meeting of the Jovian Electrical League of Philadelphia on February 4, when Billy Sunday, the evangelist, was the principal speaker. The official attendance was 636, of which 576 were Jovians. The guests were admitted by card only, and included many prominent in the professional and civic life of the city.

Mr. Sunday gave a very interesting, entertaining and instructive talk, to the point, along the line of proper living and good business principles. Joseph B. McCall, president of the Philadelphia Electric Company, also addressed the meeting. A. J. Drexel Biddle, the millionaire evangelist, said a few words.

Lynn Section Lectures.

On February 3, Major J. A. Shipton, of Fort Terry, N. Y., delivered an instructive lecture on "The Conduct of a Modern Army in the Field" to the Lynn Section, American Institute of Electrical Engineers. Some 400 men were present. The lecture was followed by a brief address by Col. Wheeler, of the Watertown Arsenal.

Great interest has been manifest in the Section this season, and it bids fair to keep the lead in numbers and enthusiasm of any local section in the country. Chairman W. H. Pratt is arranging for a weekly course of special lectures on radioactivity and recent researches into the relation between electricity and matter. In the regular course, on February 17, J. L. Woodbridge, of the Electric Storage Battery Company, is to speak on "The Characteristics and Uses of Storage Batteries."

Change of Institute Convention Program.

A change has been made in the program for the midwinter convention of the American Institute of Electrical Engineers, as announced last week.

The first session on Wednesday morning, February 17, will be occupied with an introductory address by President P. M. Lincoln, and a paper on "The Characteristics of Electric Motors Involved in Their Operation," by D. B. Rushmore.

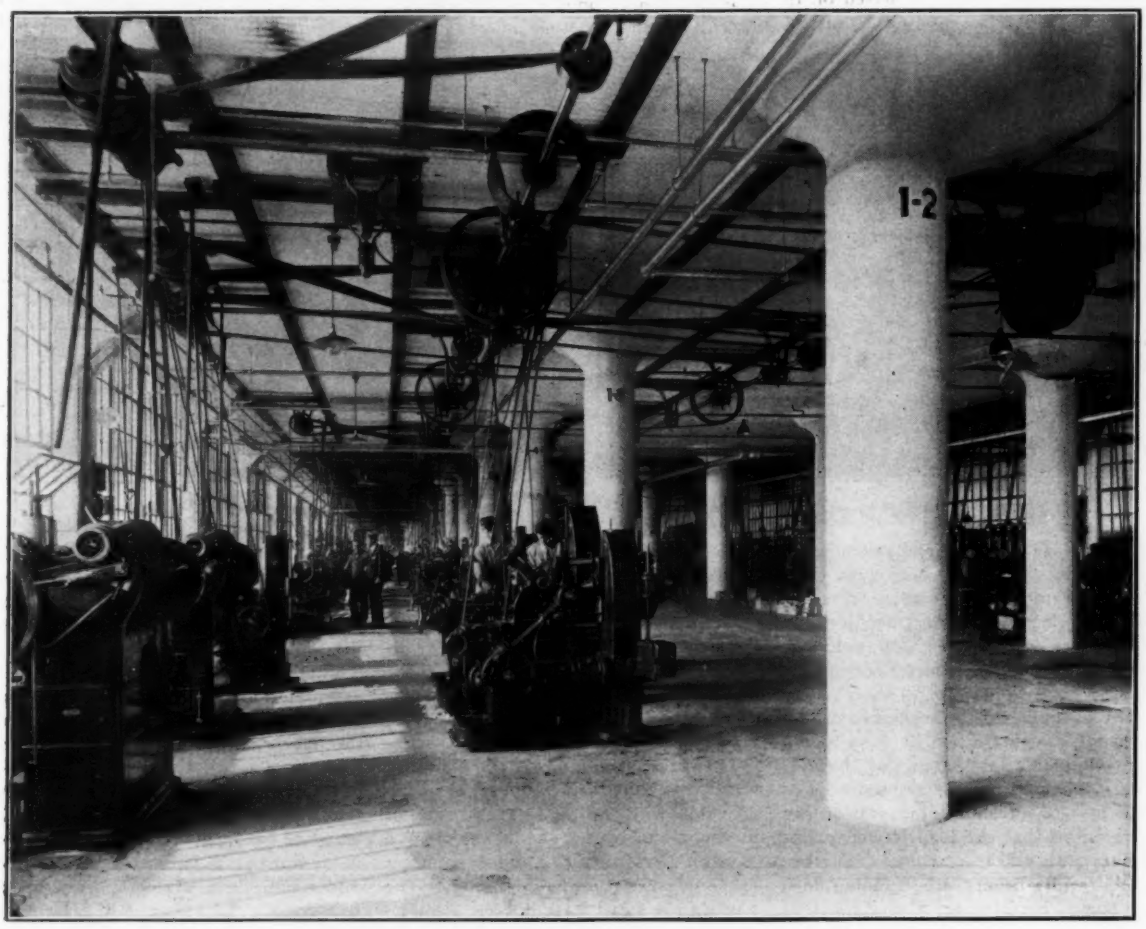
The paper on "Electrical Porcelain," by E. E. F. Creighton, has been scheduled for Friday at 2:30 p. m.

The newly issued "Yearbook" of the American Institute of Electrical Engineers shows a total membership on January 1, 1915, of 7,747, of which 450 are fellows, 1,060 members, 6,232 associates, and 5 are honorary members. There is also an enrollment of 892 students.

Electricity in the Manufacture of Electrical Machinery.

This article describes the power installation in a modern establishment manufacturing starting and lighting equipment for gasoline automobiles. Although expert in power generation, the company purchases all of its energy from the local central station.

It is appropriate that electrical accessories for gasoline automobiles should be produced under conditions of electric power. This energy is utilized to most efficient advantage by Gray & Davis, Inc., manufacturers of automobile starting-lighting systems. The company's superb factory, consisting of five stories 60 by 380 feet, constructed of reinforced concrete and providing manufacturing space of more than three acres, is located on the bank of the Charles River, in the most rapidly growing industrial region of Greater Boston.



General View of Motor-Driven Machines in Plant of Gray & Davis, Incorporated.

The energy supply is obtained from the Cambridge Electric Light Company and is three-phase alternating current at 550-volts pressure, with a small supply of 230-volt direct current for variable-speed motor operation used in dynamo tests.

The ground floor of the building is occupied by the machine shop. Here are screw machines, gear cutters, drills, milling machines, lathes and grinders, all grouped in relation to shafting overhead, arranged in four lines running the length of the shop.

The ceiling of each floor is provided with insets in the concrete construction, these holes being four feet apart both ways. Lines of framework of Southern hard pine are bolted to the ceiling through the insets provided, to give a means of attachment for the lines of shafting and also the motors. The latter are mostly installed in an inverted position, in a line through the center of the shop. There are 13 induction motors for the machine shop, each of 20 horsepower. The motors are connected by belts, about 20 feet between pulleys—the width of a bay—with the main shafts, which are located, generally, nearest the wall and are in sections of about 50 feet, and provided with couplings so that any two adjacent sections can be connected in the event of a motor failing.

From the main shafts, belts connect with lines of jack shaft, located midway between the main shafting and the motors. Machines are driven from both the main and jack shafts, thus giving four lines of machines throughout the length of the shop. The rooms are 20 feet high, the belting thus averaging about 15 feet between pulleys of the machines and those of the shafting.

Each floor of the building is divided in bays by a double line of concrete pillars, each bay being 20 feet wide. On each pillar is a letter and number to indicate the floor, number of bay, and position, whether on the north or

south side of the building. Generally, the motors are located opposite the center of a bay, the direction of their belts alternating, to connect the main shaft on either side.

All the conductors in the factory are run in galvanized conduit imbedded in the nine-inch concrete floor. Controllers are installed uniformly on central pillars convenient to the group of machines operated by the motor which it controls. These controllers are rated at 20 amperes, 550 volts. Overload and low-voltage release is provided.

The 20-horsepower machine-shop motors have a uniform speed rating of 1,200 revolutions per minute. A Blanchard surface grinder is belt connected to a 20-horsepower motor, with control apparatus on the wall nearby. A Winfield electric welding machine operating on 20 amperes, 550 volts, is employed for copper-contact spot welding.

The grouping of the machines driven from the shafting is with a view to the best obtainable load-factor for the motors connected. For the most part, machines of intermittent operation are grouped so that the load is well maintained, some of the machines being operated while others are standing idle, or some performing their function while others are running free. On the other hand, machines operated constantly are grouped together, with motor of ample power to handle the connected load. The arrangement of Gridley automatic screw machines is in a parallel oblique position to one another, so as to give space for feeding the metal rods into the machines from the central floor area. About 15 gear cutters, 20 drilling machines, and 25 frame cutting and boring machines are driven by a single motor. Nine milling machines are regularly driven by a single motor. These machines are of the Cincinnati, Milwaukee and Millers types.

The second floor is divided between the office, at the front of the building, 140 feet long by 60 feet wide, and approached by a broad stairway from the lobby on the first floor; and the quarters of the packing and shipping department, 240 by 60 feet in area.

The third floor is devoted to the assembling of parts and the testing of dynamos and motors comprised in the Gray & Davis starting-lighting apparatus. The dynamos are first given a "heat test." Four benches are provided, with a main shaft mounted on each, about 40 feet long and driven by a direct-connected 550-volt alternating-current motor. Clamps are provided on each bench for 26 dynamos, 13 on each side. A view of this equipment is shown in one of the illustrations.

The dynamo is placed in position on the bench, connected to the pulley of the shaft by a belt, and driven three hours at full load, developing 10 amperes at six volts, on a speed of 1,000 revolutions per minute.

Then the dynamo goes to one of four regulator-testing benches each provided with a direct-current 230-volt motor mounted on the bench, and a Weston voltmeter and ammeter mounted on a frame above it. The motors are rated 2.5 amperes, 5 horsepower on intermittent operation and 1.8 amperes, 0.375 horsepower on continuous operation, the speed range being 600/1,150 on intermittent and 625/1,185 revolutions per minute on continuous operation.

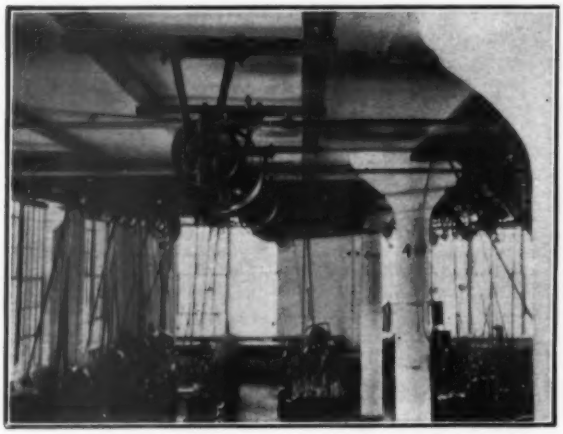
The dynamo regulator is adjusted so that it will be prepared to meet the variable-speed requirements of the car in which it is installed. As the dynamo is speeded up, the resistance is automatically cut into the field, which holds the current constant. The task of the tester is to so regulate the contact points as to meet the speed conditions which the automobile connection will impose.

The motors are likewise subjected to severe tests. After assembling, the motor goes to an inspector who tests for grounds and notes that the machine is mechanically perfect. Then it is given a "work test," which consists of placing the motor on a base on the testing bench, coupling it to a specially designed dynamometer, giving a 100-per-cent overload and run free up to 9,000 to 10,000 revolutions per minute.

A combined voltmeter and ammeter is mounted on a standard over the bench with connecting switches mounted on a wood board below the meters. The operator watches the meters to note the input of six-volt direct current, and the output is determined by scales on which a lever is imposed, which indicates the torque of the motor in foot-pounds.

The motor is then returned to the assembler and the gear reduction apparatus assembled on the motor. Then the motor is returned to the testing tables and given a test to see that the gears run properly and quietly. After that a clutch test is given to insure the clutches holding. A three-horsepower induction motor is located on the floor underneath the clutch-testing bench, belted to a 1.5-kilowatt direct-current generator. The motor under test is connected with the generator through two switches, one of which is drawn backward and forward by a small motor on the table, making and breaking the circuit about 50 times a minute, thereby starting the motor under 50-per-cent overload at those frequent intervals. This severe test is to demonstrate that the clutch will meet the most trying conditions possible.

A generator set for testing purposes is located near the tables and consists of a 10-horsepower induction motor operating on 550 volts and a 4.4-kilowatt double-current generator producing energy at 550 amperes, six volts.



Motor Driving Group of Machine Tools.

Motor-Testing Apparatus, Gray & Davis Plant.

A storage battery of three cells, with 1,100 amperes capacity, and housed in a sheet-lead structure about five feet wide, three feet high and 12 feet long, floats on the line. A marble panel is located between generator and battery and is provided with meters and switches to control and measure the six-volt energy.

The lighting of the offices and workrooms is ample and well arranged. The office lighting consists of 150-watt Mazda lamps with half-frosted bowl, installed at 10-foot intervals in both dimensions, about four feet from the ceiling, and provided with 150-watt Holophane glass shades. In all, there are 65 units for the offices, in an area 60 by 140 feet, and their location 16 feet above the floor gives an illumination amply sufficient without the use of desk lamps or other auxiliary units.

The lighting of the shops is with uniformly bay-spaced 100-watt Mazdas, three feet from the ceiling.

On the roof is a sky sign 100 feet long, presenting the words Gray & Davis. The capital letters "G" and "D" are 11 feet high, and the others nine feet high. There are 300 five-watt, 12-volt lamps in the sign, installed in Federal receptacles in the face of a white-enamel background. Though of relatively small power consumption, the sign is very effective.

Special lighting decorations are installed on occasion. During the Christmas season 1,500 30-watt, 60 100-watt and 200 25-watt lamps,—the 100 and the 25-watt lamps being tungstens—were arranged to form a festoon around the top of the building, in green, red and white. During the week of the Boston Auto Show, in March, a festoon outline will be run around the building in white and violet lamps. The design will change every five seconds by means of flashers. Thirty-watt Gem lamps will be used, the colored lamps dipped. In addition, the letters "G" and "D" will be formed by 300 red and green lamps.

The panel for lighting is housed in a sheet-metal cabinet and contains 60 circuit switches for machine-tool lighting and 12 for the daytime lighting of stairways, tool vaults, etc. On the feeders for the machine-tool lighting circuits a Palmer automatic switch is installed.

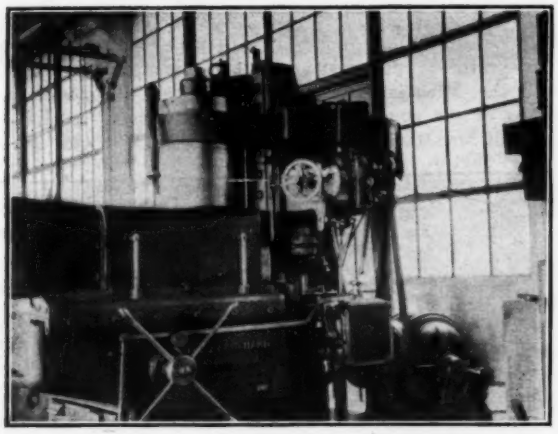
The power distribution panel is located in a nearby cabinet. The lighting is by a balanced three-wire system on the Cambridge Electric Light Company's service, on 110/220 volts.

Power consumption of the factory averages about 2,300 kilowatt-hours per day of nine hours. On the night run, 1,200 to 1,300 kilowatt-hours is the average consumption. The factory employs about 1,000 persons, all men except in the offices. About 200 of the employees are engaged in night duty.

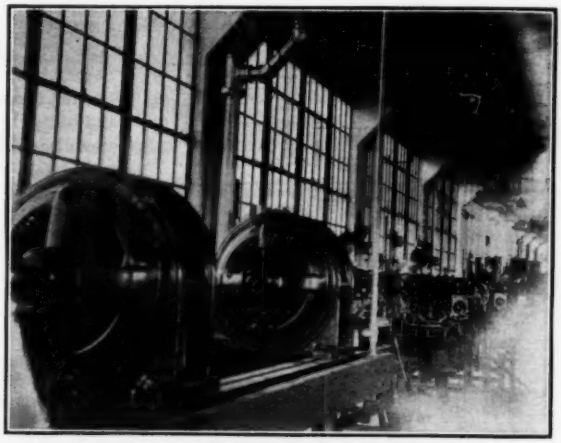
The motors installed and the apparatus or machinery connected are given in the accompanying table.

MOTOR INSTALLATION, GRAY & DAVIS, INCORPORATED.

No.	Horse-power	Application
1	2	Drives blower
1	2	Drives bearing-test machine
1	2	Direct-connected to upright drill
1	5	Belted to circular saw
1	5	Belted to band saw
1	10	Drives Ingersoll-Rand air compressor
1	3	Drives blower
1	5	Drives blower
1	10	Direct-connected to circular pump
13	20	Drives machines in groups from shafting
4	10	Drives machines in groups from shafting
4	15	Drives machines in groups from shafting
6	3	Drives machines in groups from shafting
1	10	Direct-connected to generator for testing
1	25	Operates freight elevator
1	5	Drives group of machines
1	2	Drives winding machines on benches
1	1	Drives winding machines on benches
1	1	Drives bench lathe
1	5	Drives emery wheel
1	5	Drives bench drill
1	20	Drives Blanchard surface grinder



Motor-Operated Blanchard Grinder.



Motor Operating Dynamo Testing Apparatus.

New Book for New York Electric-Car Owners.

The ninth edition of the New York Electric Vehicle Association's book of "Electric Automobile Charging Stations and Route Maps" has just been issued. This book, which is an annual publication, has several new features in the 1915 edition in addition to all of the valuable material previously used, which has been revised and brought up to date. There is a list of all charging stations in New York City and within a radius of more than 100 miles, together with the distance of each from Columbus Circle, the maximum amperage and voltage available, the hours during which service can be obtained, the cost per kilowatt-hour, and the price charged for boosting. One of the new features is a map of Manhattan and The Bronx, showing the location of all charging stations. The New York Electric Vehicle Association has sent copies to all owners and operators of electric vehicles, both pleasure and commercial, in New York and other places covered by the book. It will be sent free upon request to the offices of the Association, Irving Place and Fifteenth Street, or at the garage, Central Park West and Sixty-second Street, New York City.

Cost of Doing Farm Work with Electric Motor.

A farmer in Michigan using central-station service reports that he does all of his work around the farm with a five-horsepower motor at the following unit costs, with electricity at 10 cents per kilowatt-hour:

Feed grinding, 6.5 cents per 100 pounds.

Ensilage cutting, 6.5 cents per ton.

Corn-husking, one cent per bushel.

Wood-sawing, 14.5 cents per cord.

Water pumping, three cents per 100 gallons.

Commercial Practice
Management, Rates, New Business

Single-Wire Farm Line Paying Investment.

The Benton Harbor-St. Joe Railway & Light Company, Benton Harbor, Mich., has a very interesting method of serving farmer patrons, this consisting of a single-wire single-phase ground-return line operating at 2,300 volts, using No. 8 weatherproof copper. The approximate cost of this single-wire line runs from $200 to $250 per mile.

The company also has a two-wire three-phase construction, similar to the above, which costs $450 to $600 per mile.

In both these cases, the company uses a one-to-one transformer at the point where the grounded line leaves a standard single-phase or three-phase line, and it is claimed that these lines have been in operation for nearly two years and given perfect satisfaction to company and customers.

The income is approximately $3.00 per month per consumer, and the average transformer capacity per consumer is one kilowatt.

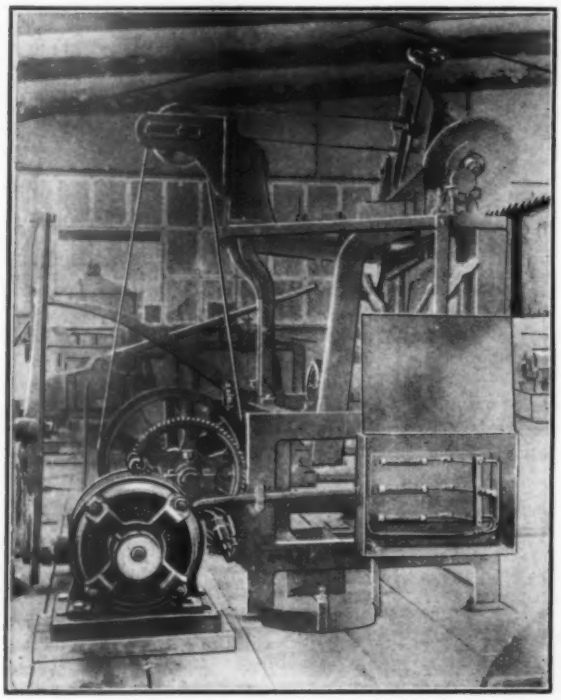
Electricity in a Modern Saw Mill.

It is probably extremely unusual to find as complete an electrical industrial installation so far removed from urban centers as that of the H. C. Johnson Lumber Company's saw-mill plant. Located on Drummond Island, Mich., where St. Mary's River brings the waters of Lake Superior to the upper stretches of Lake Huron, the plant is in touch with the Michigan mainland only by means of the company's own launches. Sault Ste. Marie, 70 miles to the northwest, and Cheboygan, 40 miles eastward, are the nearest railroad points.

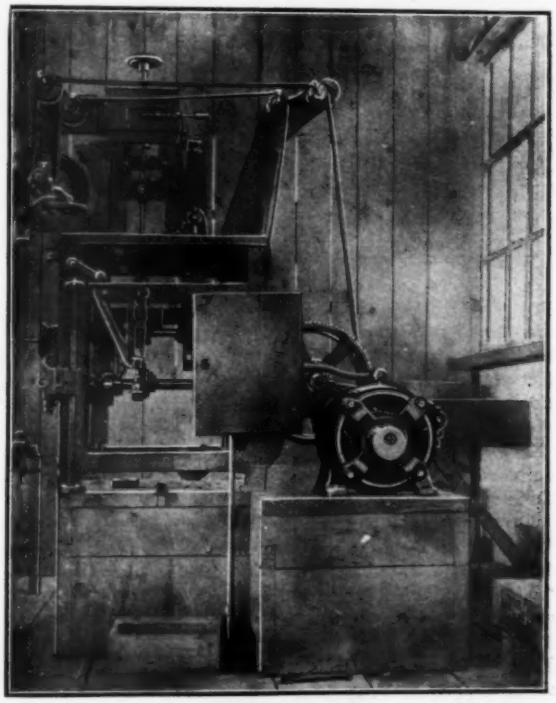
The location of the plant was determined by the harbor and shipping facilities of Scammon's Cove and because this point is the center of the company's timber holdings on Drummond and adjacent islands. The pine has been taken out years ago, therefore present lumbering activities are confined almost exclusively to hardwood lumber. Maple, beech, birch and other hardwoods are made up into rough lumber.

The mill, as it stands today, is an entirely radical departure from present practice in saw-mill construction and operation. The design of the mill structure and the layout of machine and motor applications were the work of H. C. Johnson. It had been freely predicted by manufacturers of saw-mill machinery that the plans were not feasible, but eight months' successful operation proves that the adoption of motor drive exclusively results not only in economy in first cost of the building but also in maintenance and in operation, as well as minimizing personal injury and fire hazards.

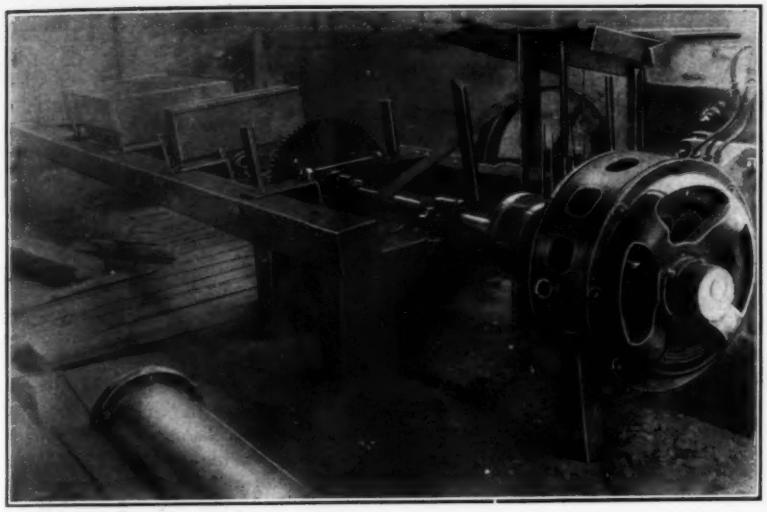
The unique feature of the mill is found in the fact that the saw floor is located on the ground, doing away with the customary lower floor with a head room of from 14 to 18 feet and filled with a maze of shafting, belting and power transmission machinery. The elimination of one floor effected a decided saving in construction, not to mention the item of shafting, belts, pulleys, etc., which alone would amount to more than the motor cost.



Motor Driving Band-Saw Grinder.



Motor Driving Circular-Saw Grinder.

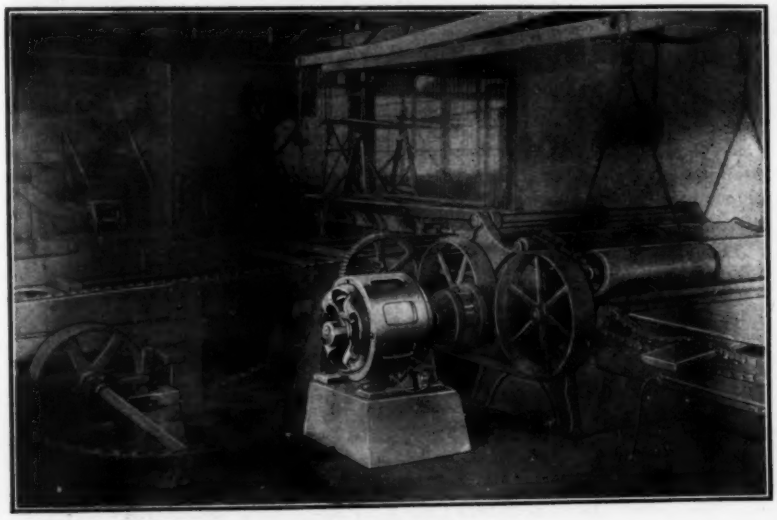


Motor Driving Slasher.

In cutting down maintenance and operating expenses, as compared with that of mills of the standard type, the Johnson plant is exhibiting some startlingly low figures from the lumber operative's standpoint. Fewer men per 1,000 feet of production, reduction of fire and liability insurance premiums; constant speed of machines; ability to run machines only when producing; economy in oil and grease cost, freedom from building vibration because the machines are mounted on their own foundations; and cleaner, better ventilated working surroundings are factors of economy and efficiency which reduce operating and maintenance costs.

The boiler-house equipment consists of three horizontal return tubular boilers, 160 pounds pressure, 72 inches in diameter by 18 feet long, set in steel casings of the Muskegon type with Dutch ovens into which the fuel is fed automatically. Directly behind the boiler room, with a fire wall between, are the engine room and machine shop. The generating plant consists of a Terry steam turbine, direct-connected to an Allis-Chalmers alternator of 625 kilowatts capacity, 1,800 revolutions per minute. three-phase, 60 cycles, 480 volts. A switchboard, in addition to its regular equipment, provides emergency control of the larger machines and department motors.

The choice of a steam turbine for a prime mover was dictated by the necessity of having a unit the continuous operation of which could be relied upon, because any shutdown in the generating plant would render every machine in the mill idle. Another determining factor was the location, too distant by far from expert assistance in case of engine trouble. After a thorough investigation, a Terry steam turbine, rated at 800 horsepower, 1,800 revolutions per minute, was decided upon and up to this writing has given uninterrupted, satisfactory service.



Motor Driving Edger.

The mill is situated directly on the banks of Scammon's Cove, and the log slide connects the saw floor with the log pond, which is a part of the bay. The logs are taken from the pond to the slide and are conveyed to the log decks inside the mill, from there being sent to the right or left mill according to quality and size. The log slide is belted to a 30-horsepower slip-ring Lincoln motor, remote-controlled from a point where the operator has an unobstructed view of the logs ascending at a speed desired by him.

Each band mill is of the latest nine-foot Garland type, carrying a 14-inch, 52-foot saw, running on wheels each nine feet in diameter, turning at about 250 to 320 revolutions per minute, giving a saw speed of from 7,000 to 9,000 feet per minute. The speed of the saws is arranged to vary according to the class of lumber and the season of the year. Each band mill is driven by its own 125-horsepower Lincoln induction motor, running at 600 revolutions per minute, belted to the mill for the purpose of securing the required speed. Additional pulleys of different sizes are kept on hand in order to change the pulley ratio and obtain the different speeds of saw travel necessary at different seasons. In practice it was found that the motors attempted to bring the bands to speed too rapidly and therefore idlers had to be installed.

From the carriages which feed the logs to the band saws, the lumber drops on the live rolls, from which it is tripped to the edger, where the bark is removed.

In the next step, the lumber passes on to the rear edger table, where the refuse is automatically sorted from the lumber, the refuse finding its way to a set of five 32-inch circular slasher saws and the lumber continuing to a transfer table, upon which it is carried to the trimmer. Here the ends of the boards are trimmed by circular saws, 24 inches in diameter, counterbalanced and so arranged that a foot trip can bring up any two saws through the table to cut a board any desired length up to 22 feet. Now the finished product is carried on a sorter table past a tallyman to waiting carts for distribution on the stock piles in the yards.

The refuse, slashed into short lengths, drops into a trough conveyor with the trimmings and is carried to an interesting machine bearing the apt name of "hog." In the hog, all but the marketable refuse is macerated into "hog-dust," which drops into another trough conveyor and travels underneath the floor to be fed automatically into the furnaces.

The filing room is equipped with the

necessary machines for both band and circular-saw filing. The machines are of the newest Hantchett type, each geared by means of raw-hide gears to a two-horsepower induction motor running at a speed of 1,200 revolutions per minute.

All the motors in this installation were furnished by the Lincoln Electric Company of Cleveland, and with the exception of the slip-ring motor driving the log slide, are of the induction type. Most of the machines are direct-connected with belted flexible couplings designed and made in the plant.

The details of the motor installation are given in the accompanying table.

Motor Installation.

The following is a list of the motors installed, with their respective drives. The supply source is three-phase, 60 cycles, 480 volts.

No.	Horse-power	Speed, R. P. M.	Application
2	125	600	Belted to two Garland nine-foot band mills.
1	75	900	Direct-connected to an M. & M. type hog.
1	30	900	Belted to log slide.
1	50	1800	Direct-connected to Garland six-saw 72-inch, double edger.
1	50	1200	Direct-connected to Garland four-foot slasher, four 32-inch saws set for four-foot lengths, and four 32-inch saws set for 16-inch lengths.
1	30	720	Direct-connected to Garland jump-saw trimmer, ten 24-inch saws, set for odd and even lengths.
1	15	900	Belted to lumber sorter table.
1	10	600	Belted to rear transfer table, edger to trimmer.
1	5	1200	Belted to refuse conveyor from edger.
1	10	720	Belted to slab and refuse conveyor to hog.
1	10	720	Belted to conveyor from hog to fuel spouts for boilers.
2	20	900	Belted to live rolls.
4	2	1200	Geared (raw-hide) to Hantchett circular saw grinder, band saw grinder, lap grinder and band-saw stretcher.
1	10	900	Belted to shafting for lathe, planer, milling machine, forge blower, small band-saw and drill press.
1	20	1800	Belted to Berlin 16-inch matcher.

Meeting of Steel Engineers.

The regular monthly meeting of the Association of Iron and Steel Electrical Engineers was held at the Seventh avenue Hotel, Pittsburgh, Pa., Saturday, February 6, at 8:00 p. m. Stewart C. Coey, assistant superintendent of the Mechanical and Electrical Departments of the Youngstown Sheet & Tube Company, read a paper on "The Relation of Physical Examination to Electrical Work."

Mr. Coey mentioned the desirability of examining the eyes of employees periodically to determine what effect artificial illumination is having upon the eye. He stated that any illuminant, having an intrinsic brilliancy of more than six candlepower per square inch, is detrimental to the eye when in the range of vision, and that all present-day lighting units except the Moore tube and the carbon-filament lamp with a frosted globe have a brilliancy greater than six candlepower per square inch; nitrogen-filled lamps having a value of 4,000 candlepower per square inch.

Sidney McCurdy, resident surgeon of the Youngstown Sheet & Tube Company, outlined the policy of physical examination and emphasized the advantages from the humane and economical standpoint.

W. O'Neil Sherman, chief surgeon of the Carnegie Steel Company, referred to the antagonism shown by labor organizations towards physical examination, and stated that he believed that this antagonism is the result of misunderstanding on the part of the labor organizations.

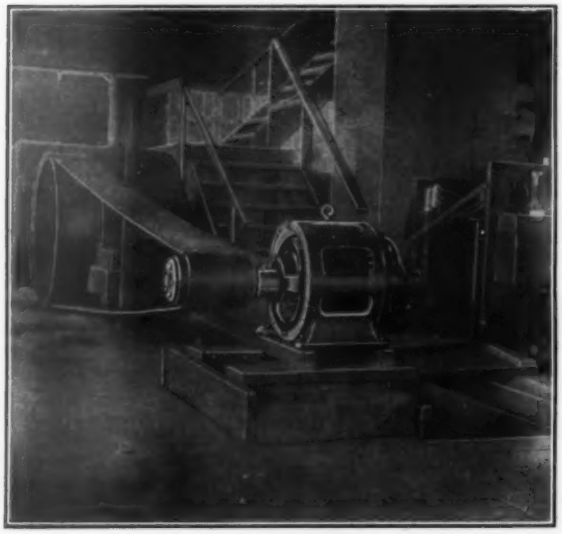
The Association of Iron & Steel Electrical Engineers is in a very flourishing condition, having a total membership of 310, seven new members being elected at this meeting.

House-Wiring Business Stimulated in Louisville.

Louisville's house owners have greeted the month's free light proposition of the Louisville (Ky.) Gas & Electric Company with much favor, especially the proposal to wire four-room houses, in connection with a number of the contractors, at a flat rate of $23, allowing a year to pay it in. This proposition was not made so much to get the business of the owner of the four-room cottage as it was to indicate to all owners of small houses that they could have their houses wired and electric lights made available at small cost. The result is just about what the company has expected and the recent contracts have come from small property owners who previously had assumed that electric light was only for the well-to-do.

Battery Charging Discussed at Chicago Vehicle Meeting.

At the meeting of the Chicago Section, Electric Vehicle Association of America, held at the Hotel Metropole, February 9, J. P. Lyons, of the Electric Products Company, Cleveland, presented a paper on "Charging in Unattended Garages." Mr. Lyons discussed the various methods of battery charging commonly employed referring particularly to the use of motor-generator sets. In regard to the latter he thought that the vertical high-speed type machine possesses a number of advantages, among which are high commercial efficiency, flexible voltage range, close regulation at variable line voltages, automatic restarting and flexible adjustment for tapering or constant-potential charging. Proper battery charging was also discussed.



Motor Driving Log Slide.

Log Slide from Bay.

Electric Vehicle Data

Electric Vehicles in Central-Station Service.

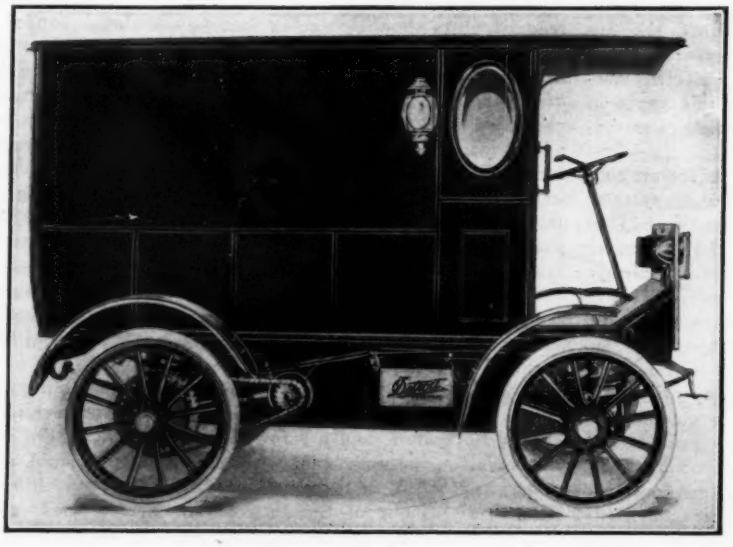
The nature of the work, which central-station companies are called upon to handle, is very diversified—necessitating the maintenance of trucks or vehicles capable of conveying small articles weighing from one to two pounds, and large pieces of apparatus weighing from ten to twenty tons; therefore, the problems confronting such companies differ greatly from similar problems met with in other lines of business. In reality, it can be said to stand in a class by itself; due to the fact that it embraces not only the small package delivery of the ordinary department store, but also the heavier work usually done by teaming contractors, as well as work requiring the use of specially designed vehicles, such as tower wagons, pole trucks, cable trucks, etc.

It is the aim of all central-station companies, to provide quick transportation at the lowest possible cost, and it is with this end in view, that the power wagon, as a means of transportation, has been adopted. Central-station policy is to give to its consumers the best possible service; and without the aid of the power wagon this is impossible. Complaints and deliveries of all kind, when attended to promptly, tend to keep a consumer in a better frame of mind, and serve to act as an advertisement of the efficiency of central-station service.

The electric vehicle has not usurped the entire field; as is evidenced by the number of gasoline vehicles in use; although the majority of gasoline cars in use are of the runabout and touring car type, which are used by heads of departments and officials; leaving the bulk of the actual work to the electric vehicles.

There are a great many questions which must be considered in the successful operation of power wagons, but possibly the most important are the conditions under which they are called upon to operate. It is a fact that in no city are these the best that might be desired. To economically operate a power vehicle it is necessary to keep it moving all the time. A vehicle which is delayed even only a few minutes at a time reduces its efficient working value. Conditions exist, however, over which we have no control or jurisdiction, that continually cause such delays. The most glaring may be attributed to the usual congestion at freight stations, while others are caused by improper devices to facilitate the quick loading and unloading of vehicles at store houses, and other points.

The majority of the transportation work done by the central station is required during the day; but it is necessary however, to have trucks that can be operated at any time. It is not infrequent, especially after bad storms, that vehicles are called upon to do both day and night service. This is accomplished by having charging stations properly located throughout the district, at which points the battery can be given a boost.



GENERAL.

Name of Company—Minneapolis General Electric Company, Minneapolis, Minn.

Business—Central Station.
Capacity of Vehicle—1,000 Pounds.
Approximate Price—$2,130.
Make of Vehicle—Detroit Electric.
Make of Tires—Firestone.
Size of Tires—34x3.
Type of Tires—Solid.
Make of Battery—Edison.
Type of Cells—A-4
Number of Cells—60.

OPERATING DATA.

Average Daily Mileage—20.
Daily Hours in Use—9.
Kilowatt-hours per Month—365.
Days in Service, per Month—26.
Cost of Electric Power per Month—$3.65.
Cost of Washing per Month—$2.70.
Driver's Salary per Month—$55.
Cost of Repairs and Renewals for Eight Months, April to November, Inc.—Battery, $164.38; Tires, $110.80; Motor, $36.65; Other, $76.33.

TOTAL AVERAGE MONTHLY OPERATING COST—$103.07.

To illustrate the stability of the electric power vehicle, proving conclusively that they are the most economical type of vehicles for central-station service, a brief summary of the average performance of 11 one-ton trucks, which have been in continual service for nine years, is given:

The average mileage performance of these 11 trucks for nine years is 4,855 miles per truck, per year, with a maximum mileage of 7,017 and a minimum of 4,016.

For the past year the average mileage per truck was 5,136 miles, with 7,756 miles as a maximum and 3,876 miles minimum — showing that they are capable of doing just as much work now, as when they were purchased, new, nine years ago.

Electrical Construction

CHEAPER WIRING.

Views of Authorities in England.

Last week the views of several British central-station men and contractors were given respecting the cheaper forms of electric wiring which have been introduced in England, with especial reference to the concentric wiring system having an exposed, grounded return conductor. Herewith the views of a leading consulting engineer and several manufacturers are given on the same subject.

FRANK BROADBENT, M. I. E. E., consulting engineer, one of the leading authorities in England on electrical installation work, examiner in electric wiring to the City and Guilds of London Institute, author of "Notes on Wiring Rules," read before the Institution of Electrical Engineers, 1901, and "Modern Methods of Electric Wiring," which appeared in this paper in 1913, makes the following observations on the situation:

"An inquiry as to the effect on conduit systems of the cheaper systems of wiring is not easily answered, because whilst the sales of conduit are continually increasing there is always the possibility that they might have been greater had these systems not been introduced. An important consideration to my mind is this, that whilst conduit owes its inception to a demand by contractors or installation engineers for something more robust and mechanical than wood molding, the new systems have been developed and boomed by cable makers, obviously for the purpose primarily of selling their cables rather than improving wiring methods, although, incidentally, the latter result might follow.

"Again, the fact that a considerable amount of work has been carried out on the new methods does not necessarily mean that so much conduit has been displaced. It may mean that, due to cheapness—where concentric systems have been employed—certain work has been done which otherwise would not have been carried out at all, or, that wood molding and not conduit systems have been affected. It must not be forgotten that for certain classes of work such as country houses where low-voltage isolated plants are used, wood molding is still largely used. The same applies to low-voltage installations supplied from public mains with or without a transformer. It is only when an isolated plant, or a double-wound transformer, is used that concentric systems are permissible, as we cannot employ any system in which one conductor is grounded or uninsulated when supplied from a public service. When a double-wire system is necessary, as for instance when supplied from a direct-current public service, the saving in cost by the adoption of any of the special systems referred to would in many cases not warrant their use in preference to conduit, and they would probably be more expensive than a wood-molding system.

"The chief merit of the special systems is to my mind not so much the reduced cost—should there in fact be any saving—but rather in their neatness and unobtrusiveness, permitting of the adoption of surface instead of concealed work. This is often a great advantage in residential property. In factories it does not apply at all, and in my opinion the inherent disadvantages of these special systems render them unsuitable for modern factory installations.

"If installation work in England were carried on under the American National Electrical Code, there would, I think, be a marked difference in cost between the cost of such systems as 'Stannos,' whether used as a twin or concentric system, and a screwed conduit system, because the weight of American conduit in the small sizes is double the weight of British conduit, viz., 75 pounds for 100 feet against our 37.4 pounds. This increases not only the cost of conduit, but of labor and fittings also. Moreover the minimum size of wire permissible under the National Code has about double the section of the minimum size permitted by our own regulations. These facts alone mean that conduit wiring in England must be very much less expensive than in the States, so that there is not the same margin of economy to be effected by any new wiring system.

"If, therefore, these modern systems should be introduced into the States, it is quite possible that they would affect conduit wiring to a much greater extent than is possible here. Cab-tyre is really a cable-armoring rather than a wiring system, and has given good results where wood molding, conduit, and ordinary open wiring have proved unsatisfactory. I believe that a concentric system is being developed on these lines also, which it will be possible to use on grounded supply systems."

THE SUN ELECTRICAL COMPANY, LIMITED, of London, manufacturers and sellers of both the "Kalkos" system and "Stannos" wires, states that its Kalkos system was introduced for the very highest class of work. "Naturally it is expensive, though not necessarily more expensive than the best class of screwed conduit, over which it possesses many important advantages—particularly its entire absence from condensation trouble. The 'Stannos' system consists of a metal-cased rubber-insulated conductor with suitable fittings, enabling ordinary standard accessories to be used; it comes within the class of expensive wiring systems.

"Our sales in both these systems have been considerable, and are steadily growing; that means that business in steel conduit must be affected to about the extent of the business done with the newer systems. We, however, sell steel conduit as well. Our sale of this is also increasing, there is certainly no apparent falling off.

"We do not think that any one system or class of systems is ever likely to monopolize, or even take a very large share of, electric installation work generally. There is a personal element to be considered, among other things, and some consulting engineers today even prefer wood casing, and we believe in the future that all the really reliable systems will continue to be sold."

CREDENDA CONDUITS, LIMITED, of Ashton, Birmingham, states that it is rather difficult to answer the question as to the effect of concentric and other similar systems upon conduit, "as the Stannos and similar wiring systems are only suitable for surface work and for buildings where it is not desirable to interfere with the decorations or architectural features by cutting chases to receive the tube, etc. It does not need argument to prove the superiority—both from an electrical, mechanical and safety standpoint, of a conduit system of wiring over any concentric system. Again, on the score of accessibility and

renewal, with a conduit system, if it is done on proper lines, there is no difficulty in renewing the conductors, whereas with any concentric system, unless it is on the surface, and consequently an eyesore in any decorative effect, to renew any faulty material necessitates very considerable injury to the decorations and likewise heavy expense. On these grounds, and because up to the present, although the concentric system is very much prior to the conduit system, it has not yet had any serious effect on the conduit business, we do not anticipate that the conduit business is likely at present to be affected in any way by the concentric system, unless much greater and more radical improvements are made in the concentric system than at present exist. As a matter of fact, in our opinion, the concentric system is rather a fad of a few consulting engineers than a serious proposition for general use."

SIMPLEX CONDUITS, LIMITED, of London, writes: "In looking through some of the American papers we have noticed that the contractors on the other side seem quite opposed to the cheap forms of wiring. We believe the 'Stannos' system is the one about which they are particularly concerned. This system was put on the market in this country some four or five years ago, but we have not found it to have any detrimental effect upon the growth of the more expensive conduit system—in fact, we think the tendency over here is toward the universal adoption of the conduit system."

Angle-Iron Motor Platform.

A motor platform made of angle iron has its advantages over one made of heavy lumber; it is neater; does not take up as much space; lasts a good deal longer; and does not cost any more.

The platform here illustrated is made of two pieces of one-inch angle iron (heavier if desired) bent as in Fig. 1, with two half-inch iron rods (heavier if desired) with eyes on one end and threads on other, bolted to the base of each piece and supported on the joists as shown. The angle iron is bent with the angle *in*, with one side perpendicular to the floor.

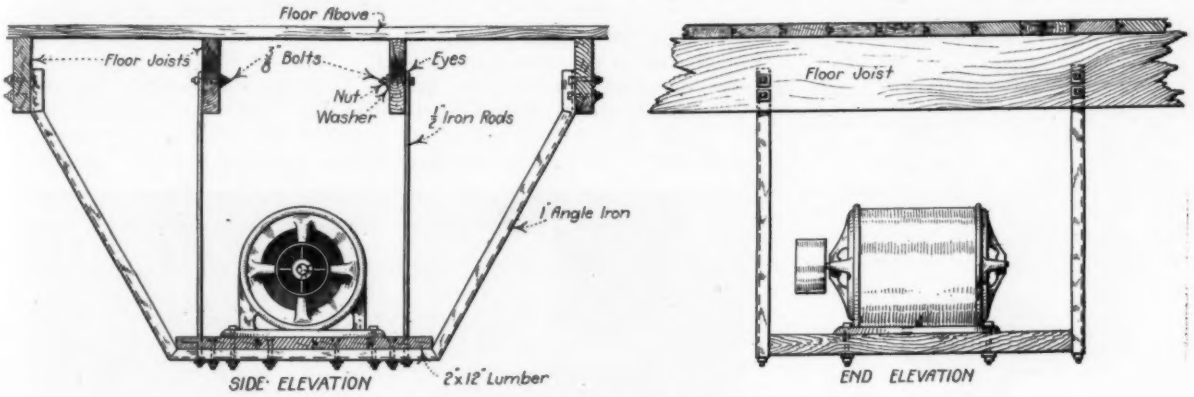


Fig. 1.—Two Views of Motor Platform Supported by Angle-Iron.

Fig. 2 shows how to bend angle iron. Decide the angle at which the iron is to be bent and at what point. On one side of the iron draw, through this point, a perpendicular line DC. Angle FBH is the angle desired. Draw one-half of angle FBA on each side of DC, these angles being ADC and BDC. Cut angle ADB out with a hack saw. Then bend at D till AD and BD meet and the iron will be at angle FBH.

It is better that a blacksmith bend the iron as it has to be heated to make a good job.

This platform has to hang on at least four joists as in Fig. 1 but if joists are not available, the iron rods can be threaded on the ends shown with eyes and put through holes bored *through* the ceiling.

The floor of the platform is of 2-by-12-inch lumber (heavier if desired), resting in the angle of the iron, bolted to frame as in Fig. 1.

This platform will hold motors of sizes up to 15 horsepower.

The motor should be set as in Fig. 1 to get best results as the platform is braced only on sides shown.

To have the motor facing in the other direction, the platform should be hung as in Fig. 3.

The size of the platform is decided according to the size of the motor.

Edward Kemp.

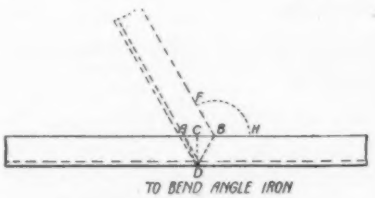


Fig. 2.—Bending Angle-Iron.

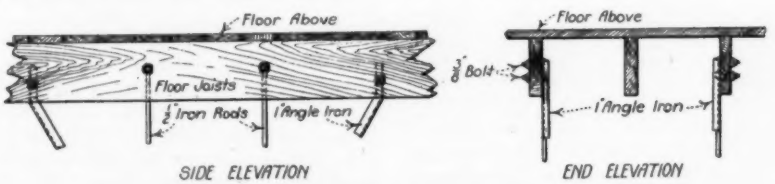


Fig. 3.—Another Method of Hanging Platform.

New Jersey Contractors Meet.

The annual meeting of the New Jersey Electrical Contractors' Association was held on January 23, at Passaic, N. J. The meeting was well attended.

Addresses were made by W. A. Cox, C. C. Harvinson and H. H. Newman, of the Public Service Electric Company; G. A. Collinson, of the New Jersey Underwriters' Association; W. S. Gibson, of the Electrical Bureau, Passaic; J. E. Alexander, of the General Electric Company; S. H. M. Agnew and T. S. Dorris.

The following officers were elected:

President—E. P. Strang, Camden.

Vice-president—C. R. Newman, Passaic.

Secretary—John Van Dyke, Asbury Park.

Treasurer—Paul H. Jaeling, Newark.

Board of Directors—C. F. Adams, H. C. Heidrick, C. R. Newman, B. F. Sprague, Richard P. Ward.

National Electrical Code to Be Revised in March.

The Electrical Committee of the National Fire Protection Association will

meet in New York City during the week beginning March 21. Executive sessions will be held on Monday and Tuesday. Open sessions will be held on Wednesday and Thursday, March 24 and 25, in the rooms of the New York Board of Fire Underwriters, 123 William Street.

This body passes upon proposed revisions of the National Electrical Code, which take place every two years, and the meeting this year is of especial interest to contractors, inspectors, manufacturers and others on account of the amendments which have been proposed to the Code.

Keeping Workmen's Time.

Keeping time, especially on small jobs, is a perplexing problem, as the workmen will not or usually do not write out the time spent on work as they go along, but will wait until the end of the day and then fill out the ticket as nearly as they can remember, so that it will make a full day. This trouble is overcome by the use of a time stamp and a ticket made out for each job; each ticket has two impressions on it, one when the job was started and one when it was finished. The clock is key set so that the time cannot be changed. By this means an accurate record can be kept of time on small jobs, assembling fixtures and any work where it is essential to know the exact time spent on any certain piece of work.

Time Stamp.

Such a clock with time stamp is illustrated herewith. It is sold at a price that puts it within easy reach of the average electrical contractor.

A Timely Window Display.

Much has been written and said relative to the value of show-window advertising, particularly timely window displays of electrical dealers. Exclusive of department stores there is perhaps no other field where the goods available for display can be utilized to such advantage as electrical devices.

A striking illustration of this is the case of a New York electrical store which made the interesting telephone display shown in the accompanying illustration. The display, as will be observed, pertains to the opening of the transcontinental telephone line and also shows other applications of telephone equipment and service. This window was on view at 8 o'clock a. m. on January 26, although the transcontinental line referred to was not opened until 4 o'clock p. m., January 25.

Among the Contractors.

R. G. Littler, of the West Coast Engineering Company, Portland, Ore., has been retained by the Western Cooperage Company as electrical engineer on the new plant which it is now erecting at St. John, Ore. Specifications have been drawn for the motors and proposals on these are being received at the offices of the Western Cooperage Company in the Northwest Bank Building. The installation will consist of 30 to 40 motors totaling approximately 1,000 horsepower. The present installation will, however, be but about half of the plant when completed, and the entire installation will be designed for a total of 1,800 to 2,000 horsepower. The West Coast Engineering Company will make the plans and specifications and install the plant complete and ready for operation. The plant is expected to be ready for running in June or July.

Timely Telephone Display.

The Blumenthal-Kahn Electric Company, of Baltimore, Md., has been awarded the contract for furnishing the electric lighting fixtures, telephone and call bells in the new office building for the Standard Oil Company being built at Charlotte, N. C. The same company has been awarded the contract for the electrical equipment in the Salisbury National Bank Building, at Salisbury, Md.

A. C. Bender, formerly chief electrician at The Hub, a Chicago department store, has joined the forces of H. D. Lighthall, an electrical contractor, as estimator and city foreman. Mr. Lighthall is at 112 North Fifth Avenue.

The Thompson Electric Company will establish offices and storerooms at 102 West Lafayette Street, Tampa, Fla. The officers of the company are S B. Thompson, president and treasurer, and J. MacD. Thompson, vice-president and secretary. The company will do a general electrical contracting business and also deal in electrical merchandise.

The National Electric Company, of Baltimore, Md., has been awarded the entire contract for the electrical work in the filtration plant for the city of Baltimore. The contract involves about $10,000 of work and calls for switchboards and other electrical equipment. Post-Glover switchboards and panelboards will be used throughout. The same firm is also wiring the new home for the Elks at Baltimore. James Posey is consulting engineer on the latter structure.

The Levy Morton Electric Supply Company, of Columbus, Ga., has opened a branch house at Americus, Ga. J. M. Flournoy, graduate electrical engineer, is in charge of the Americus branch. The offices are located in the Windsor Block on Jackson Street.

Dollar Wiring Kinks.

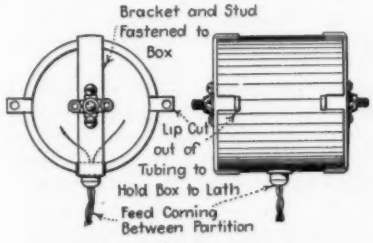
Every reader is invited to contribute to this column. It does not matter how few words are used to explain a "Dollar Wiring Kink," provided the idea is made clear; and if a diagram is necessary, a rough pencil drawing will serve. The idea itself must, of course, be new and bright. A dollar will be sent to the contributor upon publication.

Dimalite for Heating Pads.

One finds that in using heating pads it is difficult to get just the right amount of heat to suit every user. As most heating pads take 60 watts, which is just the capacity of the regular "Dimalite" one can get four degrees of heat very conveniently by using the above arrangement. E. M. Raetz.

Improvised Outlet Box.

In wiring old houses, and in fact in some other places, there is sometimes not sufficient room in the partitions for two standard boxes, where wall outlets are to be placed in adjoining rooms. In a case of this kind I took a piece of steel



Outlet Box Made of Steel Tubing.

tubing three inches in diameter, cut it to the right length, and drilled a hole in the center to take a straight BX connector. This is shown in the accompanying illustration. This serves as a box to feed a bracket fixture in each room. To fasten a bracket a strap is placed across the end of the tube, with holes for fastening the stud. At the sides of the tube two projections are left for fastening it to the wall.

George E. Taylor.

Knife Blades For Testing.

In testing for trouble or polarity, a very useful kink to avoid much skinning of wires, is to use a double-bladed knife, placing the bare end of the test wire under one of the blades by closing the blade on it, and then using the other blade, open, to make contact on the wire to be tested. This makes a quicker contact point and one that can be easily taped, which in conduits or cramped spaces means much.

Ben R. Browne.

Economy in Cutting BX.

Here is a little stunt for saving BX on old-house wiring jobs. In cutting BX for fish work, there is usually considerable material wasted; or there is time wasted cutting it in an awkward position. If the fish wire is first measured, and cut to say 12 feet in length, an accurate measurement of length of BX required can be made, after fish wire is snaked across ceiling, by deducting the length of fish wire not pulled in. This requires no more time than the old way, cuts down waste of material to a minimum and makes it possible to cut the BX in a comfortable and safe position.

W. F. Schmidt.

Taking Up Floor Boards.

To take up oak floor boards I put a tension on end of board by inserting a wedge under it and then place a block 1 by 2 inches of hard maple (which I always keep in my grip) on the adjoining board whose groove engages the tongue of the board to be removed. The block should rest lengthwise on the second board, close to the end, and must come to the grooved edge of same, but must not extend over on the first board. Having carefully placed the block, strike it a smart blow with a hammer and it will split the tongue off of the first board as neatly as if done by a knife. Then move up the wedge and repeat until sufficient tongue is split off to answer the purpose. This method has three great advantages; it saves much time and effort, you ruin no tools by contact with nails and with only a little care boards are not disfigured.

V. R. Riordan.

Locating Short-Circuits Alone.

In locating short-circuits, screw the plug end of an extension cord into one side of the cut-out block instead of a lamb bulb. The lamp end can be hung out of a window or so placed that it can be easily seen from the location of the circuit, thus saving many steps to and from the cut-out board.

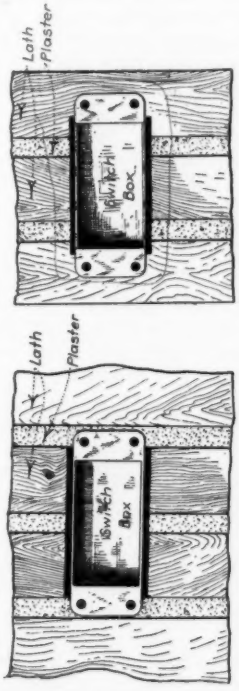
C. W. Higinbotham.

A Handy Material Box.

A handy material box can be constructed from any ordinary box that may be at hand. A convenient size is a box 10 by 10 by 10 inches. A false bottom should be put in this box 2.5 inches from the original bottom. The part of one side between this false bottom and the real bottom should be removed. A drawer containing eight compartments is constructed to just fit in the space between the two bottoms. A label is put on each one of these compartments to indicate the size of screws for which it is to be used. A small button is then attached to hold the drawer in, and a drawer pull is screwed on the front of the drawer. If this box and drawer are properly made, the box may be upset without the screws getting out of their respective compartments. Ray E. Smith.

Mounting Flush Switch on Lath.

In cutting a plastered wall for a flush switch it is better to locate the switch so that one whole lath and part of the two adjacent ones are cut through, rather than to cut two laths entirely



Proper and Improper Mounting of Switch Box.

through. This is shown in the accompanying illustration, where the upper portion shows a correct installation with rigid mounting; the lower portion illustrates the poor way of doing it.

E. A. Shoemaker.

To Protect Wires From Sliding Doors.

Often where sliding doors roll back into partitions, there is not enough arm space to work in. Generally one or two switches are to be set on the outside wall of such partitions, with the cables dropping down inside the partition. It is important that the door should not scrape these cables. This can be accomplished by taking a piece of lath about a foot long and using it as a clamp, by catching it with a long wood screw from the other side of the wall. This lath will draw the cables tightly against the inside of the wall. The head of the screw is covered with wall paper, so that it does not show.

George E. Taylor.

Public Service Commissions

Conducted by William J. Norton

DISTRICT OF COLUMBIA.

Frederick L. Siddons has been appointed as Associate Justice of the Supreme Court of the District of Columbia and has been succeeded as a member of the Public Utility Commission by Louis Brownlow.

Standards of Service. The Commission has prescribed regulations for electric service in the District of Columbia which are effective as of February 15, 1915. The rules cover location of meters, watt-hour meter testing and regulation of voltage.

NEW YORK—First District.

Interest on Deposits. The Commission adopted an order establishing regulations for gas companies in receiving and caring for deposits made by consumers. The law allows a gas company, before supplying gas, to exact a deposit from the intending consumer in an amount equivalent to about two months' gas bills. Inquiry by the Commission has developed the fact that inadequate records were kept, and the new order requires the keeping of accurate accounts and the payment or crediting of the legal interest at 6 per cent per annum upon such deposits. The order also requires the companies to distribute to their customers circulars containing the provisions of the law authorizing such deposits and the order of the Commission establishing the regulations.

Second District.

Filing of Schedules. The Commission has adopted regulations governing the filing of contracts, and prescribing the form and governing the filing and publication of rate schedules of gas and electrical corporations, and municipalities. The order, as first issued, ordered the company to comply with the regulations on or before February 15, 1915, but the date was later changed to March 15.

Every gas and electric corporation and municipality is required to file with the Commission and keep open for public inspection: (1) Schedules showing all rates, and charges made, established, or enforced, or to be charged or enforced, and all rules and regulations relating to rates, charges, or service used or to be used, and all general privileges and facilities granted or allowed applying generally throughout the territory served by such gas corporations, electrical corporations, or municipalities. (2) A certified copy of each and every contract with street or other railroad corporations, and other gas corporations or electrical corporations, covering the furnishing of gas or electricity primarily for the propulsion, lighting, and heating of cars, and for resale, in effect and in force on said date, or which have been entered into to become effective and enforced subsequent thereto, and any such contract entered into or in effect after said date shall be filed with the Commission within five days from the date of its execution; and (3) a certified copy of each and every contract for special service for particular occasions covering a limited period of time not exceeding twenty consecutive days for such occasion.

The order also prescribes the form of schedules and specifies the manner and method of preparing, publishing and filing complete schedules and subsequent amendments.

The loose-leaf plan is to be used so that changes in the schedules may be made easily. The order as first issued by the Commission required all schedules to be printed, but later changed the order to permit the filing of typewritten schedules.

The order provides, in part, as follows: "Every schedule shall show on the rules and regulations leaves all the rules which apply generally to the furnishing of gas or electricity, as the case may be, and all the regulations, special clauses, or riders which in any ways relate generally or specifically to service rendered or to be rendered, or any privilege or facility granted or allowed, under any service classification provided in the schedule.

"The leaves on which the definitions of terms and explanations of abbreviations and reference marks used in the schedule are given shall show all the technical terms, abbreviations, and reference marks used in the schedule, with definition of each such term and full explanation of each such abbreviation and reference mark. When ratings are used, based on capacity of installation or a percentage thereof, a table of equivalents for estimating such ratings must be given. . . .

"Service classification leaves show for each classification:

"(a) Classification number.

"(b) Whether for fuel, lighting, or power, or a combination of any two or all.

"(c) Class of consumers to whom available, according to purpose of use or location in service area, or both, as the case may be.

"(d) Character of service, description. (Continuous, Limited-period, Optional, Auxiliary and Emergency.)

"(e) Guarantee: The amount, if any is required, and on what it is based; also show hereunder the amount of minimum charge, if any is required.

"(f) Rate: The base or unit rate or rates or series of unit rates used in compiling the total charge to consumer. When a system of discounts from a base rate is used, instead of a series of unit rates, such discounts must here be shown. Such discounts should not, however, be confused with maintenance or prompt payment discounts.

"(g) Maintenance discounts: If any discounts or reductions in unit rates are allowed in consideration of the consumer paying for lamp renewals or other maintenance charges, such discounts or reductions must be given, with a clear explanation of the conditions under which they are allowed.

"(h) Prompt payment discounts: Give the regulation governing when allowances in the prices charged are made in consideration of the time within which bills are paid.

"(i) Such rules and regulations, special clauses, or riders as may apply thereto.

"Note: As all rules and regulations, special clauses, or riders are required to be shown, with specific number or letter, on the rules and regulations leaves, any rule, etc., may be made a part of any service, classification by giving reference thereto by its number or letter; but any special rule or regulation applying to a particular classification must be shown in full in connection therewith."

All proposed changes in the schedules are to be filed with the Commission thirty days prior to the date effective. Provision is made for the putting in effect of a new rate on less than statutory notice, but the Commission says: "This authority will be exercised only in cases where actual emergency or real merit is shown, but in no case to permit changes which effect increases in rates or charges, or which

in any way operate to decrease the value of the service to consumers."

WISCONSIN.

Walter Alexander, of Milwaukee, has been approved by the Senate as a member of the Railroad Commission. As a result of this action two new men are placed on the Commission.

The Milwaukee Street Railway Fares Case. Owing to a falling off in the revenues of the street car company in Milwaukee the Commission has rescinded its order, issued August 23, 1912. The original order directed The Milwaukee Electric Railway and Light Company and the Milwaukee Light, Heat and Traction Company to sell 26 tickets for one dollar. The matter was carried to the State Supreme Court, on the ground that the franchise guaranteed a lower fare, but the court sustained the Commission, and later an appeal was taken to the United States Supreme Court, where the matter is now pending.

The rescinding order is based on a complaint of the mayor of the City of Cudahy, Milwaukee County. He claimed that the order was unreasonable and unjust, in that it prevented the companies from making a fair return upon their investment. In a 25-page opinion the Commission discusses the finances of the company in detail, and concludes that the present earnings do not warrant the continuance of the order. The decision says: "The increases in the operating expenses and fixed charges of the respondent companies, and the failure of their gross and net revenues to maintain their ordinary actual growth during the past few years are due to causes that are wholly beyond the control of the respondent companies. These changes, however, as the facts herein clearly show, have resulted in this, that the net earnings of the respondent now are, and for some time have been considerably lower on the investment than the rates or costs at which it is well known new capital for similar undertakings can in the long run be had."

Municipal Utilities. The attorney general, in an opinion to the Railroad Commission, holds that there is no provision in the statutes which will permit a town, city or village which owns its water works or lighting plant, to sell or lease it to any private corporation. The attorney general points out that the statutes contain provisions for the taking over of plants but none for their disposal. He refers to authorities on municipal law, and rules that these utilities are property for public purposes, and must remain in the hands of the community.

The Muscoda Mutual Telephone Company. In the petition of Frank Pospichal *et al.* against the Muscoda Mutual Telephone Company, it was alleged that the secretary and treasurer of the company assumes management of its affairs without authority from the board of directors. The Commission says: "The Commission has no jurisdiction over the relations between a utility official and the board of directors, unless such relations impair the service or create unreasonable rates; and it does not appear that either condition exists in the present case." In answer to complaints as to service furnished by the telephone company, the respondent was ordered to comply with the standards for telephone service fixed in the Commission's general order of August 13, 1914.

International Engineering Congress.

The technical success of the International Engineering Congress, to be held in San Francisco, September 20 to 25, is now well assured. Notwithstanding the difficulties arising as a result of the present European war, the Committee on Papers is able to count on from 200 to 250 papers and reports covering all phases of engineering work and contributed by authors representing some 18 different countries. The Congress will therefore be truly international in scope and character, although the representation from the countries involved in the European war will naturally be less than originally planned.

The papers are now rapidly coming in and their character gives the fullest assurance that the proceedings will form a most important collection of engineering data and a broad and detailed review of the progress of engineering art during the past decade.

The Committee of Management is now issuing to all important engineering societies, in this country and abroad, invitations to appoint official delegates to attend the sessions of the Congress, and the presence of a considerable body of such delegates is well assured.

Membership in the Congress with the privilege of purchasing any or all of the volumes of the proceedings is open to all interested in engineering work.

For full particulars apply to W. A. Cattell, secretary, 417 Foxcroft Building, San Francisco, Cal.

One of the British Columbian Government exhibits at the Panama-Pacific Exposition is a complete working model of the Coquitlam-Buntzen hydro-electric plant, which supplies power to Vancouver and vicinity. The two lake dams, the tunnel connecting the lakes, the pipe line and power house are all shown in proper scale.

Questions and Answers.

All readers of the Electrical Review and Western Electrician are invited to submit questions and answers to this department. Full names will not be printed except where the writer indicates his willingness therefor. Anonymous communications will not be considered. Questions relating to electrical matters of any kind will be inserted. Answers from our readers should be received in this office preferably within ten days of the date of publication of the question, and will be published in a subsequent issue. Payment will be made for all answers published.

Questions.

No. 262.—Electrically Driven Street Sweeper.—Has any electrically driven suction street sweeper ever been tried out by any municipality or street-car company?—F. N. S., Toronto, Canada.

No. 263.—Rewinding Motor.—I have a series motor running at 1,100 revolutions per minute that I want to have run at 1,700 revolutions. I would like to know whether to rewind the armature alone or to rewind both the armature and fields. At first I intended to rewind only the armature and connect the fields in multiple, which it seemed to me would answer the same purpose as rewinding the fields; then I thought I would find out what other readers suggest.—J. B., New York City.

No. 264.—Garage Alarm.—At a garage located in a residence district much annoyance has been caused to the neighbors during the winter nights by the practice of drivers loudly sounding the horn to call the attendant to open the doors when they wish to return their cars to the garage. Is it not possible to devise some electrical arrangement whereby a bell or gong will be automatically rung inside the garage as soon as a car arrives at the door without compelling the driver to leave his seat?—F. E., Evanston, Ill.

No. 265.—Electric Vehicle Control.—In the older types of electric vehicles it used to be the custom to connect up the battery in some sort of series-parallel arrangement, I believe, which was claimed to be very efficient. Is this system still used to any extent and, if not, why not?—J. T. S., Yonkers, N. Y.

No. 266.—Lighting Shallow Window.—Is there any way of lighting uniformly the rear display surface of a show window only 14 inches deep, 4 feet wide and 6 feet 6 inches high?—M. P., South Bend, Ind.

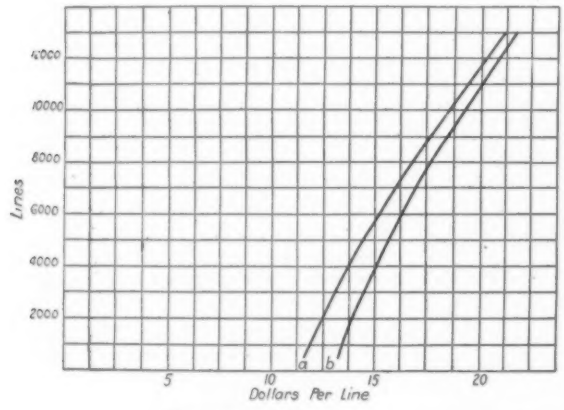
Answers.

No. 240.—Life of Gas-Filled Tungsten Lamps.—What is the longest life record as yet attained on test or in service with the new nitrogen-filled tungsten lamps?—P. C. U., Springfield, O.

Although I have no actual data avail-

able, I have heard from a reliable source of some nitrogen lamps burning over 5,000 hours. These were on life test in a laboratory and, of course, not subjected to such voltage fluctuations as met with in actual service. Such a record is not extraordinary under laboratory conditions and throws little light on actual service performance in this particular. The rating of the nitrogen-filled lamps is 1,000 hours and with the lamps now turned out this is quite generally attained or slightly exceeded. Much variation existed as to life in the early lamps, most having rather short life. With improvement in manufacturing methods the lamps now turned out are of quite uniform quality and average fully up to or above rating. —N. D. L., Lynn, Mass.

No. 259.—Relative Cost of Manual and Automatic Telephony.—What is the relative first cost of manual, central-energy exchange and substation equipment for, say, 10,000 telephone lines and of full-automatic equipment for the same number of lines? What is the relative operating and maintenance cost of the two systems? Does the reduction in operating cost of automatic equipment offset the increase in fixed charges?—H. L. F., Buffalo, N. Y.



No. 259.—Fig. 1.

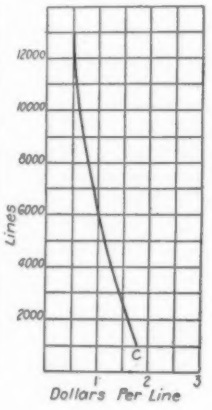


Fig. 2.

For capacities around 10,000 lines it is necessary with the manual system to use a multiple switchboard. The costs of common-battery multiple switchboards vary widely, due to many causes. As the number of multiple jacks increases in far greater ratio than that of the increase in lines, it is evident that the cost per line of a multiple board will be greater in the case of a board having many lines than in one having but few. Multiple boards of the same type and adapted to serve the same number of lines differ widely in cost, because of the fact that the cost is very largely dependent upon the average number of lines terminating in answering jacks at each position. Obviously a board having 160 lines per position terminating in answering jacks will have fewer sections, and therefore fewer multiple jacks than one having only 100 or 120 answering jacks per position. Hence, the heavier the service the more costly the board. On account of the above conditions, it would be impossible to give a consistent relative cost of the two systems. However, by use of the curves given in Fig. 1, a cost under average conditions may be obtained, and compared to the automatic figures to be given presently.

Curve *a* (Fig. 1) shows the cost per line of multiple switchboards ranging in size from 1,000 to 13,000 lines and having an average of 160 answering jacks per position; 160 jacks is the usual number except in heavy traffic portions of large cities. Curve *b* shows the cost plus the power equipment, the cost of the power plant being in each case based upon the ultimate capacity of the board rather than its immediate capacity. Separate power-plant cost is shown in Fig. 2. The foregoing curves were plotted from "shotgun" diagrams representing a large number of actual installations. Complete automatic apparatus, including central-office equipment and subscribers' telephones (one telephone per line equipment), cost about $35.00 per line. This does not vary much for large or small exchanges. For central-office equipment alone, including distributing frames, power plant and all automatic switching apparatus, the cost, installed, is from $22.00 to $25.00 per line. Common-battery manual subscribers' sets average $8.50 for wall type and $9.50 for desk type. The automatic telephone instrument as a separate item will average about $13.00 each for desk or wall type.

The automatic is burdened with about 50 per cent greater maintenance costs. The current consumption is also a great deal larger than with the manual, although it has improved wonderfully in the past year or two. The final relative operating and maintenance costs vary so widely as to make each proposed change from manual to automatic a special study.

The question of the relation of operating expenses to total fixed charges is such a variable one that it is almost impossible to predict for any plant, at the present state of the art, just what the relation will be. As a general thing, but by no means the positive rule, the decreased operating expenses do not offset the increase in fixed charges where the plant is very large or small; but in between these two extremes is a strip of variable width, in which there is an equality of decreased operating expense and increased fixed charges. There may also be cases where the decrease in operating expense is greater than the increase in fixed charges, although this is indeed rare.—H. E. W., Chicago, Ill.

No. 261.—Dynamic Braking.—In the case of direct-current hoist motors it is possible to effect dynamic braking by a control system that connects the starting resistance as a shunt to the armature when stopping the motor. Has any similar scheme been worked out for polyphase alternating-current hoist motors?—D. B. L., Warren, O.

Dynamic braking is obtained by using the motor as a generator to deliver energy to an external circuit. This external circuit may be simply a resistance inserted especially for the purpose, or it may be the circuit which furnishes the power.

With direct current two ways are in common use for dynamic braking. One is to connect the control rheostat across the motor armature while exciting the field from the line, thus using the rheostat as a load. In this case all the energy due to the descending load must be absorbed by the rheostat, but no power is taken from the line except that required for the field excitation. The second method, and the simpler one, consists of reversing the motor and cutting it in on the line. In this case the rheostat must be able to absorb the energy stored by the descending load, and a further supply of energy from the line. The first method is the more preferable and economical.

For hoisting with alternating current, induction motors are generally used, these having characteristics very similar to the direct-current shunt motor. In Europe, I believe, alternating-current commutator motors of the repulsion type are coming into increasing use for this class of work because of their ability to operate without rheostatic control, while still permitting of regenerative control for braking purposes. Control is obtained with these motors by shifting the brushes.

There are two ways for obtaining dynamic braking of induction motors, namely by alternating current and by direct current. When alternating current is used, it is necessary to reverse the field of the motor. This is, in most cases, accomplished by reversing one phase of the two-phase or three-phase motor, a simple matter of changing the two wires of any phase going to the motor. One effect of reversing the

magnetic field of the motor is to cause a voltage rise in the secondary or rotor. The extent of this voltage increase will depend upon the speed at which the motor is operating and will be a maximum when the motor is running at synchronous speed, at which time the voltage in the secondary will be twice that at standstill. Under these conditions the secondary must be sufficiently insulated to be able to withstand twice normal pressure. In some cases, where a high secondary pressure is especially objectionable, this difficulty can be overcome by applying but half normal line voltage to the primary instead of full line pressure, in which case the resistance of the secondary should likewise have half of its previous value.

To obtain the most effective and uniform braking effect, with a minimum of current, a variable resistance is required in the rotor circuit. This resistance should be a maximum at the time of applying the dynamic and should be decreased as the speed of the motor decreases. The variable resistance used for this purpose may be an ordinary metallic rheostat or a liquid rheostat, this latter being extremely well suited for this work on account of its uniform resistance change. By its means a very close control may be obtained, and constant torque where desired. From the above remarks it is seen that the squirrel-cage induction motor is not well adapted to this form of regenerative control on account of having, within practical limits, a secondary of constant resistance. To give high starting torque without excessive current, the squirrel-cage type of motor must have a high-resistance secondary; on the other hand, to run efficienctly and economically requires that the rotor have a low resistance. Both these requirements can only be obtained by the induction motor with wound rotor. From this it is seen that the squirrel-cage type of motor is not only unsuited for dynamic braking, but is inefficient for hoist work.

In those cases where the magnetic field is reversed and resistance inserted in the secondary, it is generally found necessary to allow ample rheostat capacity over that required for acceleration purposes only. When using alternating current for braking the supply circuit must be opened as the motor comes to rest otherwise the motor will pick up in the opposite direction.

The second method of dynamic braking of induction motors consists of applying direct current to the stator windings. The direct current may be applied across the winding, whether it be connected in star or delta as the case may be; or the winding may be opened and all phases connected in series, depending upon conditions. On account of the greater simplicity of the switching arrangements, however, it is generally preferable not to open the stator winding but to pass the direct current through two phases of the winding, if connected in star, and through two phases in parallel in series with the third for a delta-connected stator. The magnetic field required by direct current is much greater than that required by alternating current to give the same braking effect and thus the danger of a voltage rise occurring due to an accidental open-circuit is much greater and must be at all times guarded against. While the braking effect of alternating current is greater than direct current, the latter has the advantage of absorbing a very small amount of energy, whereas with alternating current quite a large amount of power is taken from the line.

It is beyond the scope of this brief answer to go into all the relative advantages and disadvantages of these two methods of control, but it may be said that where infrequent braking is required alternating current will often be found prefereable on account of the fewer complications, while direct current is generally chosen where stopping is frequent, because of the great saving in power.

Dynamic braking has numerous advantages over the mechanical brake, the chief of which are, perhaps, the saving in wear on the equipment, and the time saved in repairs. The result is, in other words, greater output. The use of dynamic braking permits of control of the hoist motor without any special effort on the part of the operator, and this is a matter of importance where the hoists are being worked hard for long hours. With heavy loads and long drops the amount of energy which must necessarily be dissipated requires that a friction brake, if used, must be of ample capacity. Such a brake must therefore be bulky and will tend, on this account, to be expensive as well as inconvenient. On the other hand, electric braking requires rheostats and control gear, which in some cases would be needed anyhow. With a friction brake the wear of material is often quite a heavy item of expense where the service is severe, and frequent renewals are therefore necessary. With the dynamic brake practically the only material needing replacement are the contactors on the control gear, which in any case require very little attention and are comparatively long-lived. Whether alternating current or direct current be used, and whatever the method of obtaining electrical retardation, a mechanical brake must be used to hold the load after the motor has come to rest. There will be wear on this brake, and replacements will therefore be necessary, but only occasionally. Where direct current is used for retarding induction motors, a source of direct current must, naturally, be available, and for this purpose motor-generator sets are usually employed. The generator portions of these machines are generally of low voltage.

When choosing motors for hoist work, in conjunction with dynamic braking, it must be remembered that while the dynamic is working so also is the motor, because in this instance the terms motor and brake are synonymous. The temperature rise of the motor will often be considerably above that which would have occured had not dynamic braking been resorted to. In other words, the capacity of a motor will probably be reduced when dynamic braking is utilized.

At the present time the opinion of engineers is at variance as to the relative performance of alternating current and direct current for dynamic braking and for hoist work in general, and both systems have their advocates. There are a large number of installations in service utilizing both forms of electrical supply; and both are giving good, reliable and efficient service. The number of direct-current installations exceeds those using alternating current. But, on the other hand, it is only of comparatively recent date that alternating current has come into use at all for this class of work.

Direct current is eminently well suited to hoist work from all viewpoints, both as regards the motors and the control; alternating current was not quite so well-suited, but of late it has fast been coming up to the direct current, and personally I believe that before long alternating current will be used to a much larger extent for all heavy work.—Ivor L. Kentish-Rankin, Chicago, Ill.

Undeveloped Power in Eastern Rivers.

The rivers of the northeastern and middle eastern portions of the United States are the best known in the country and the earliest in point of development, and their usefulness as sources of power and centers of industry has been demonstrated for several generations. Nevertheless it has been shown by the work of the United States Geological Survey during past years and is demonstrated in one of the reports of the Survey that in spite of the long familiarity of manufacturers and industrial men in general with most of these rivers, the water resources they afford have not yet been appreciated and by no means developed to their fullest extent. In fact, there are very few rivers in this great region in which the development of water power has come anywhere near the maximum possible degree of usefulness.

The report mentioned, Water-Supply Paper 261, contains records of flow during several years of the principal rivers in New England, New York, New Jersey, Pennsylvania, and Maryland, which empty into the Atlantic Ocean.

Electrical Engineering Problems.

By R. G. Hudson and W. V. Lyon.

DIRECT CURRENTS.

Problem 23.

Given the following data regarding a 20-kilowatt, 230-volt, compound (long shunt) generator: terminal voltage constant at all loads without adjustment of excitation; speed, 1,200 revolutions per minute; resistances (hot) of the armature between brushes and of the series field, 0.12 ohm and 0.005 ohm, respectively; normal shunt-field current, 2.6 amperes; power input to generator at no load (terminal voltage 241 volts and shunt-field current 2.8 amperes), 1,995 watts; power input to generator at no load (terminal voltage 235.5 volts and shunt-field current 2.7 amperes), 1,928 watts.

Find the efficiency of this machine (*a*) at full load and (*b*) at half load. What per cent of the input to the generator at full load is lost in (*c*) stray power, (*d*) heating the armature winding, (*e*) heating the series-field winding, and (*f*) heating the shunt-field winding?

SOLUTION OF PROBLEM 23.

Answer to Question a.

The power input at no load (1,995 watts) is absorbed by the stray power and the shunt-field loss, the armature loss at no load being negligible. The shunt field loss is given by [19].

$$P=241\times2.8=675 \text{ watts.}$$

The stray power loss then equals 1,995—675 or 1,320 watts.

The full-load line current of a 20-kilowatt 230-volt generator is 20,000/230 or 87.0 amperes. The field current being 2.6 amperes, the armature or series-field current equals 87.0+2.6 or 89.6 amperes. The armature voltage at full load [3] therefore equals 230+89.6(0.12+0.005) or 241.2 volts. The armature current at no load being equal to the shunt-field current at no load, the armature voltage in the first no-load test was 241+2.8 (0.12+0.005) or 241.3 volts. Since for equal speeds the stray power loss varies with the armature voltage, the above value of the stray power corresponds very closely with that at full load. Hence the full-load value of the stray power may be taken as 1,320 watts.

The heating loss in the armature winding at full load is given by [20].

$$P=(89.6)^2\times0.12=963 \text{ watts.}$$

The heating loss in the series winding at full load is given by [20].

$$P=(89.6)^2\times0.005=40 \text{ watts.}$$

The heating loss in the shunt-field winding at full load is given by [19].

$$P=230\times2.6=598 \text{ watts.}$$

The total loss in the machine at full load then equals the summation of the stray power, armature, series-field and shunt-field losses or

$$P=1,320+963+40+598=2,921 \text{ watts.}$$

The input to the generator at full load equals the summation of the losses at full load and the output at full load or

$$P=2,921+20,000=22,921 \text{ watts.}$$

Since the efficiency of a dynamo equals the output divided by the input,

$$\eta=20,000/22,291=87.2 \text{ per cent.}$$

Answer to Question b.

When the terminal voltage is 235.5 volts the power input at no load is 1,928 watts. Of this power input 235.5×2.7 or 636 watts is charged to the shunt-field loss. The stray power loss under these conditions is then 1,928—636 or 1,292 watts. The line current at half load equals 10,000/230 or 43.5 amperes and the aramature current equals 43.5+2.6 or 46.1 amperes. The armature voltage at half load therefore equals 230+46.1 (0.12+0.005) or 235.8 volts. Since the armature voltage under test conditions was 235.5+2.7(0.12+0.005) or 235.8 volts, the above value of the stray power (1,292 watts) corresponds to that at half load.

The heating loss in the armature winding at half load is given by [20].

$$P=(46.1)^2\times0.12=255 \text{ watts.}$$

The heating loss in the series winding at half load is given by [20].

$$P=(46.1)^2\times0.005=10 \text{ watts.}$$

The heating loss in the shunt winding at half load is given by [19].

$$P=230\times2.6=598 \text{ watts.}$$

The total loss in the machine at half load then equals the summation of the stray power, armature, series-field and shunt-field losses or

$$P=1,292+255+10+598=2,155 \text{ watts.}$$

The input to the generator at half load equals the summation of the losses at half load and the output at half load or

$$P=2,155+10,000=12,155 \text{ watts.}$$

The efficiency at half load is then given by

$$\eta=10,000/12,155=82.3 \text{ per cent.}$$

The efficiency at any particular load may be calculated in this manner if a no-load input test is made with the machine running at rated speed and with an armature voltage corresponding to the particular load. If an efficiency curve from no load to full load is desired, no-load input tests should be made at rated speed for several degrees of excitation, recording power input, terminal voltage and shunt-field current. From these data a stray-power curve may be plotted from no load to full load and from this curve a continuous efficiency curve may be plotted, the points on the curve being calculated as explained above.

Answer to Question c.

From the results obtained in the Answer to **Question a** the stray power loss at full load is 1,320/22,921 or 5.8 per cent of the full-load input.

Answer to Question d.

The armature loss is 963/22,921 or 4.2 per cent of the full-load input.

Answer to Question e.

The series field loss is 40/22,921 or 0.2 per cent of the full-load input.

Answer to Question f.

The shunt-field loss is 598/22,921 or 2.6 per cent of the full-load input.

The summation of these percentage losses; 5.8, 4.2, 0.2 and 2.6 gives 12.8 per cent. This subtracted from 100 per cent gives 87.2 per cent and thus checks the answer to **Question a.** The efficiency of a direct-current generator depends upon its size, speed, weight and cost, the efficiency increasing as each of these factors increases. A machine rated at one kilowatt will have an efficiency of about 80 per cent, while a machine rated at 500 kilowats will have an efficiency of about 93 per cent. The efficiency of any given machine is greatest at about full load and it is for this reason that machines are so often installed in duplicate so that for varying degrees of load on the station the machines in service may be operated approximately at their rated loads.

SOLUTION OF PROBLEM 73.

Answer to Question a.

If the governors are adjusted to give the same speed-load characteristic, the alternators will always deliver their proper shares of the load. That is, their outputs will always be in proportion to their ratings. In this case, since the alternators are of the same design, they will divide the load equally between them. If

ALTERNATING CURRENTS.

Problem 73.

Part I.—Two three-phase, 1,500-kilovolt-ampere, 5,500-volt alternating-current generators of the same design are operating in parallel. They are driven by prime movers whose governors are at first (in questions *a* and *b*) adjusted to give the same speed-load characteristic. The effective resistance and synchronous reactance of each generator are, respectively, 0.37 and 8.3 ohms per phase. The armature windings are connected in star. These generators deliver a total constant load of 2,400 kilowatts at a power-factor of 0.8 and their rated voltage.

(*a*) If the excitations are adjusted so that the armature currents are in phase, what are the excitation voltages in each and how do the armature resistance losses compare with their full-load values? (*b*) If the excitation of one is reduced and that of the other is increased until the first operates at a power-factor of 0.95 (lagging) what are the excitation voltages and how do the armature resistance losses compare with their full-load values? (*c*) If the governors of the prime movers and the excitations of the alternators are now adjusted so that the first delivers 1,500 kilowatts at unit power-factor, at what power-factor does the other operate? Compare the armature resistance losses in each with their full-load values. Draw a vector diagram showing the excitation voltages of each.

(*d*) With the governors still set as in the preceding question, the excitations are adjusted so that the alternators operate at the same power-factor. What are the armature currents in each alternator? Compare the armature resistance losses with their full-load values. Draw a vector diagram showing the excitation voltages of each.

Part II.—An alternator which has a capacity of 1,500 kilovolt-amperes is operated in parallel with one which has a capacity of 1,000 kilovolt-amperes. If they are delivering a total load of 1,800 kilowatts at a power-factor of 0.75, what are the proper conditions of operation—in regard to power output and power-factor—for each alternator? What adjustments would you make to bring these conditions about?

the alternators deliver the same power and operate at the same power-factor, then their armature currents are the same. This is the best condition for two equal alternators operating in parallel. Each armature current is one-half of the total load current. The total load in kilovolt-amperes is

$$2{,}400/0.8=3{,}000.$$

Since the power outputs and the power-factors of the two generators are the same, each will take one-half of the total kilovolt-ampere load. That is, each will be operating with its full-load current.

The armature resistance losses in each have their full-load values. Each alternator is operating under the same conditions so that their excitation voltages are equal and in phase. The vector diagram is given in Fig. 27a.

The power per phase is

$$P=1{,}200/3$$
$$=400 \text{ kilowatts.}$$

The voltage per phase is

$$V=5{,}500/\sqrt{3}$$
$$=3{,}180 \text{ volts.}$$

The current per phase is

$$I=400{,}000/(3{,}180\times 0.8)$$
$$=157 \text{ amperes.}$$

The horizontal component of V is

$$V_h=0.8\times 3{,}180$$
$$=2{,}540.$$

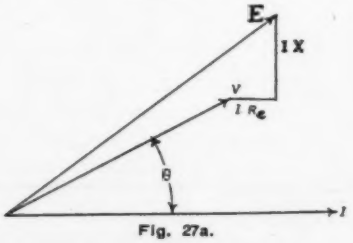


Fig. 27a.

The vertical component of V is

$$V_v=3{,}180\times 0.6$$
$$=1{,}910.$$

The horizontal and vertical components of the excitation voltage are

By [19a] $E_h=2{,}540+157\times 0.37$
$=2{,}598$

$E_v=1{,}910+157\times 8.3$
$=3{,}215.$

The excitation voltage per phase is

By [20a] $E=\sqrt{2{,}598^2+3{,}215^2}$
$=4{,}130$ volts.

Answer to Question b.

If we neglect the slight changes that occur in the armature resistance losses, the power output of an alternator operating in parallel with others is not affected by varying the field excitation. If the power output is unchanged the projection of the armature current on the terminal voltage is also unchanged. The vector diagram is given in Fig. 28a.

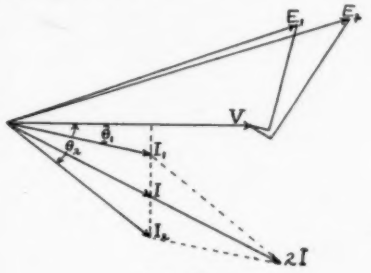


Fig. 28a.

The vectors labeled I in Figs. 27a and 28a are the same.

By [1a] $400{,}000=3{,}180 I_1\times 0.95$
$I_1=132$ amperes.

The horizontal components of I_1 and I_2 are each equal to

$$132\times 0.95=126.$$

The vertical component of I_1 is

$$132\sqrt{1-0.95^2}=41.$$

The vertical component of the total current, $2I$, is

$$2\times 157\times 0.6=189.$$

By [26a] $189=41+(I_2)_v$
$(I_2)_v=148.$

By [27a] $I_2=\sqrt{126^2+148^2}$
$=194$ amperes.

The armature resistance losses vary as the square of the armature current. The resistance loss in the first generator is now

$$(132/157)^2=71 \text{ per cent}$$

of its full-load value.

The resistance loss in the second generator is now

$$(194/157)^2=153 \text{ per cent}$$

of its full-load value. This generator is considerably overloaded. It shows the importance of adjusting the excitations so that both generators operate at the same power-factor.

In order to find the excitation voltage, E_1, it is best to turn the diagram so that the current, I_1, is horizontal. The horizontal component of V will then be

$$V_h=3{,}180\times 0.95$$
$$=3{,}020.$$

The vertical component is

$$V_v=3{,}180\sqrt{1-0.95^2}$$
$$=990.$$

By [19a] $(E_1)_h=3{,}020+132\times 0.37$
$=3{,}069$

$(E_1)_v=990+132\times 8.3$
$=2{,}090.$

By [20a] $E_1=\sqrt{3{,}069^2+2{,}090^2}$
$=3{,}710.$

In order to find the excitation voltage, E_2, it is best to turn the diagram again so that I_2 is horizontal.

$$\text{Cos } \theta_2 = 126/194 = 0.65$$
$$\text{Sin } \theta_2 = 148/194 = 0.763.$$

The horizontal and vertical components of V are now

$$V_h = 3{,}180 \times 0.65 = 2{,}066$$
$$V_v = 3{,}180 \times 0.763 = 2{,}425.$$

By [19a] $(E_2)_h = 2{,}065 + 194 \times 0.37 = 2{,}137$
$(E_2)_v = 2{,}425 + 194 \times 8.3 = 4{,}035.$

By [20a] $E_2 = 4{,}570$ volts.

Comparing these values with that obtained in **question a** shows that the excitation of the first generator has been reduced about as much as the excitation of the second has been increased. Observe also that the current delivered by the first has become more leading and that that delivered by the second has become more lagging than in **question a**. These would always be the results of altering the excitations of generators operating in parallel.

Answer to Question c.

The vector diagram is given in Fig. 29a.

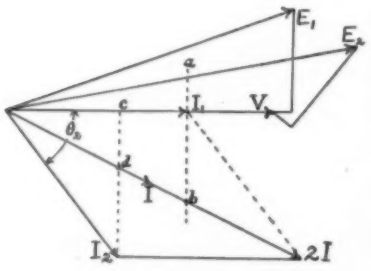


Fig. 29a.

The vector labeled I is the same as in the other figures.

If the first generator is operating at unit power-factor its current is

By [1a] $1{,}500{,}000/3 = 3{,}180 \times I_1$
$I_1 = 157$ amperes.

If the terminal voltage, V, is taken along the horizontal axis, the vertical component of I_1 is zero. The horizontal and vertical components of the total current, $2I$, are

$$2I_h = 252$$
and $2I_v = 189$

By [26a] $(I_2)_h = 252 - 157 = 95$
$(I_2)_v = 189 - 0 = 189$

By [27a] $I_2 = 212$ amperes.

By [28a] $\text{Cos } \theta_2 = 95/212 = 0.448.$

The second generator is operating at a power-factor of 44.8 per cent.

The current in the first generator has its full-load value and so the armature resistance loss is normal. The armature resistance loss in the second generator is

$$(212/157)^2 = 1.82$$

of its full-load value, and thus this generator is considerably overloaded.

Answer to Question d.

If the governor setting is unchanged the current, I_1, must move on the vertical line ab so that $I_1 \cos \theta_1$ may remain constant. Otherwise the power output would vary. Likewise I_2 must move on the vertical line cd. If the excitations are adjusted so that the currents are in phase, they will swing until I_1 is at b and I_2 is at d. The output per phase of the first generator is 500 kilowatts and that of the second is 300 kilowatts. The armature currents are

By [1a] $500{,}000 = 3{,}180 I_1 \times 0.8$
$I_1 = 197$ amperes.
also $300{,}000 = 3{,}180 I_2 \times 0.8$
$= 118$ amperes.

DIRECT CURRENTS.

Problem 24.

The no-load power input to a 20-kilowatt, 230-volt, four-pole shunt generator, driven at 1,200 revolutions per minute and separately excited to a terminal voltage of 240 volts, is 1,320 watts. The armature is 14 inches in diameter and is wound with a simplex lap-winding containing 300 conductors. The flux-cutting length of each armature conductor is 10 inches.

Neglecting the effect of armature reaction, find the reactive torque of the armature (*a*) at no load under the above conditions and (*b*) when the armature current is 80 amperes. Find (*c*) the power input to this generator when the armature current is 80 amperes.

This problem illustrates the relation between current, flux and torque in a dynamo.

ALTERNATING CURRENTS.

Problem 74.

Two three-phase alternators, each of which is rated to deliver 1,000 kilovolt-amperes at 1,320 volts, are directly coupled to the shaft of a water turbine. The armature windings are connected in star and have an effective resistance of 2.2 ohms and a synchronous reactance of 54 ohms per phase. The field structures have 30 poles. These alternators will not operate satisfactorily, that is, they will not divide the load equally between them and operate at the same power-factor. The probable cause is that the field structures are not properly set on the shaft. The alternators deliver a total constant load of 1,500 kilowatts. If the excitations are adjusted so that the first delivers 1,000 kilowatts at unit power-factor, the second delivers 500 kilowatts at a power-factor of 0.50. The terminal voltage has its rated value throughout the problem. (*a*) What is the angular displacement of the field structures relative to one another and what should be done to correct this? (*b*) The coupling is now adjusted so that the excitation voltages are in phase. If the field currents are also adjusted so that they are equal, what load does each alternator deliver and at what power-factor does it operate? Compare the present armature resistance losses with those when the load was divided as originally described. (*c*) The field currents are further adjusted so that the excitation voltage of one is increased 20 per cent, and that of the other is reduced the same amount. What power does each alternator deliver and at what power-factor does it operate? What are the resistance losses in each alternator?

This problem illustrates the operation of two alternators in parallel that are mechanically coupled together.

Solutions of the above problems and two new problems will be printed in the next issue.

The armature resistance loss in the first generator is

$$(197/157)^2=1.58$$

of its full-load value.

The armature resistance loss in the second generator is

$$(118/157)^2=0.58$$

of its full-load value.

Answer to Part II.

Alternators in parallel should divide the total load in proportion to their ratings and should operate at the same power-factor. In this case since their capacities are in the ratio of 2 to 1 the first should deliver 1,200 kilowatts and the second 600 kilowatts and they should both operate at a power-factor of 0.75. In order to bring this condition of operation about first adjust the governors of the prime movers until they divide the load properly and then adjust the field excitations until they both operate at the same power-factor and with the proper terminal voltage.

Dayton Company Section Organized.

On February 1 a meeting was held of the employees of the Dayton Power and Light Company who are members of the National Electric Light Association at which it was decided to form a company section of the National Electric Light Association and a committee consisting of O. B. Reemlin, chairman, J. Himes, F. B. Steele, J. E. Lautiner and Stanley Perry was appointed as an Organization Committee.

Another meeting of the members was held on February 3, at which was received the report of the Organization Committee and the constitution of the Dayton Power and Light Company Section of the National Electric Light Association was adopted.

Election of officers then followed and resulted as follows: Thomas F. Kelly, chairman, J. K. Himes, vice-chairman, J. Fitzpatrick, Jr., secretary, L. K. Funkhouser, treasurer. F. M. Tait, O. H. Hutchings, O. B. Reemelin, M. H. Wagner and F. B. Steele were elected to membership upon the Executive Committee.

Wednesday, February 3, there was a meeting of all the employees of the Dayton Power and Light Company at the initial meeting of the Company Section, when the employees had the pleasure of listening to a very able address by T. C. Martin, secretary of the National Electric Light Association. Mr. Martin explained to the employees the many benefits to be derived through membership in the National Electric Light Association and also told of the many wonderful sights to be seen at the San Francisco exposition.

Mr. Martin also explained the many spectacular lighting effects that were being carried out at the exposition.

NATIONAL INDEPENDENT TELEPHONE ASSOCIATION.

Annual Convention, Chicago, February 3 to 5.

The eighteenth annual convention of the National Independent Telephone Association, which was held at the Hotel LaSalle, Chicago, on Wednesday to Friday of last week, was the best convention ever held by this organization. The total registration was over 600, the sessions were all very well attended, and the subjects presented covered more comprehensively matters of live interest to telephone men than heretofore.

The first session opened on Wednesday morning with President N. G. Hunter, Wabash, Ind., in the chair. Edward E. Gore, on behalf of the Chicago Association of Commerce, extended a cordial welcome to the convention. S. G. McMeen, president of the Ohio State Telephone Company, Columbus, O., responded on behalf of the Association.

Presidential Address.

The annual presidential address was then presented by Judge Hunter. In this he reviewed the activities of the Association during the past year, and touched various features attending the management and operation of the telephone business. He narrated the chief features of the negotiations undertaken with the American Telephone & Telegraph Company respecting a modification of the long-distance toll-line proposal that had been submitted by the American Company to the Department of Justice in December, 1913. In these negotiations, which were carried on at various periods throughout the year, N. C. Kingsbury represented the Bell interests, and the Association was represented by its officers and a considerable number of its directors. The conferences were also participated in by representatives from the Independent Telephone Association of America. As a result of these conferences, modifications in the proposed long-distance contract have been agreed upon, but the concessions made by the Bell system have not been entirely satisfactory to the independent interests, and further negotiations are therefore anticipated.

One of the important things undertaken by the National Association was the getting in closer contact with the governmental departments at Washington. In order to further this the headquarters of the Association were moved from Chicago to Washington, and the secretary devoted most of his time to activities at the capital. This permitted keeping in close touch with the Interstate Commerce Commission, the Department of Justice, and Congress. One of the things accomplished was an amendment to the Reyburn bill, which provided originally that all common carriers be required to secure from the Interstate Commerce Commission a permit before issuing securities or stock in any amount. Since interstate telephone companies were included in this, strong efforts were made to relieve them from this burdensome requirement, and through representation by the Association's officials this was accomplished. Consent was obtained from the Interstate Commerce Commission and the Department of Justice whereby a representative of the National Association was permitted to appear on behalf of member companies who might be required to send representatives before these bodies. This service is provided for members of the Association without expense beyond the regular membership fee.

The officers of the Association have participated in a number of meetings of different state associations, particularly those in Indiana and Ohio, and it is hoped to co-operate more closely with the various state associations in the future. Judge Hunter urged an increase in the funds available for increasing the activities of the Association. The Association stands for fair play in the field of reasonable and constructive (not destructive) telephone competition. If this fails a conservative control by governmental authority in the interests of both companies and the public is the tribunal of last resort.

Judge Hunter at this point entered into a full discussion of the advantages of the local company, as compared with rendering of service by a foreign corporation. He urged merging of the two independent national associations, since there is no real reason for the maintenance of two such bodies. He spoke of the educational and social uplift work achieved through the telephone development of the country. From the commercial standpoint the telephone business has a most favorable future ahead of it. There is no reason, therefore, why telephone companies should curtail their purchases; on the contrary, they should promote the revival of business by adopting the slogan "Buy It Now."

Several amendments to the by-laws of the Association that had been approved by the Board of Directors, were submitted by Secretary MacKinnon. These were approved by the vote of the convention. A Committee on Credentials was appointed by President Hunter, and the convention elected a Nominating Committee and a Committee on Resolutions.

Government Ownership in Canada.

The session on Wednesday afternoon opened with an inspiring address by "Catch My Pal" Patterson, the famous Irish minister. A paper entitled "Results of Government Ownership of Telephone Systems of Canada" was presented by Francis Dagger, electrical and telephone expert of the Ontario Railway and Municipal Board, Toronto, Canada. He opened his remarks by showing that the growth of independent telephony was the outcome of a protest against the exactions of private monopoly in the telephone business. The independent telephone men in the United States deserve to be congratulated on the success achieved in combating the evils of monopoly control.

The development of a strong sentiment for government ownership in Canada arose from the lack of telephone development in the western provinces of the Dominion. Government ownership in that country is restricted to the three provinces of Manitoba, Saskatchewan, and Alberta. At the beginning of government ownership of telephone lines in this section there was a population in the three provinces of about 600,000, and serving this large population there were but 7,000 telephones; of these about 4,000 were in the city of Winnipeg alone. On account of the scattered nature of the rural population in those developing provinces it was almost impossible to secure private capital for building the telephone lines demanded. Therefore, an appeal was made to the government, and it responded. Absolute government ownership is not insisted on, however. In Manitoba there are only 7 telephone systems owned by the government, out of a total of 34, and in Saskatchewan only 5 are government-owned out of a total of 360. However, the government ownership has stimulated the telephone development, so that although in 1905 there were only 6,800 telephones in the three provinces, last year the total was over over 98,900. The manner in which the government systems were organized and placed under the control of commissions was explained in detail. Mr. Dagger said that from the first, the government-owned systems had been a complete success, both from the financial and operating standpoints.

Service Betterment in Iowa.

A paper entitled "The Iowa Idea" was presented by H. B. Shoemaker, of the Commercial Telephone Company, Toledo, Iowa. What is known as "the Iowa Idea" is the development of the activities of the Iowa Independent Telephone Association. This idea is a spirit of service for the improvement of every branch of the telephone business. The Iowa Association is attempting to secure for all the telephone companies of its state, both non-members, as well as members, and also for the public, an improvement in telephone methods that will raise the general standard of service throughout the state and benefit all the companies, even the smallest exchanges. At the time of the Iowa Association's convention last year an operators' school was held, as a result of the success of which it was decided to employ an expert lady operator as the traveling chief operator of the Association. She has devoted all her time to visits to exchanges throughout the state, spending a week or more in each town, depending upon the size of the exchange, and instructing the operators in the most approved methods of carrying on their work. This aid has practically revolutionized the service in many of the exchanges, and it has enabled the achievement of not only a much higher standard of service, but the securing of considerable economy.

The Iowa Association also took up with Iowa State College at Ames a broadening of the engineering extension department of this school by the inclusion of courses in telephony. These have been organized along four lines: (1) Operators' schools. (2) School for plant men. (3) Technical service bureau. (4) Bulletins bearing on the problems of the telephone business. Mr. Shoemaker described the work undertaken under these four heads, and showed how the technical and practical information supplied has been of the greatest value, particularly to the smaller companies. One of the bulletins published in this line, dealing with the construction, care and operation of rural telephone lines, has been gotten up in words of one syllable, and in the simplest manner explains how the operation of these rural lines can be vastly improved. It is aimed to broaden this work through correspondence courses, by residence study at Iowa State College, and by other methods. One of the things being taken up is a study of proper methods of accounting.

G. R. Johnston, vice-president of the Ohio State Telephone Company, Columbus, O., then made an address entitled "The Individuality of the Operator." He paid tribute to the loyalty, faithfulness and resourcefulness of operators, and stated that he had absolute confidence in their ability to keep secrets that they may overhear on the telephone lines. He thought that rules regarding the conduct of operators should not be too rigid, particularly in the handling of unusual conditions. Mr. Johnston said he had found that telephone operators require less supervision than employees in any other kind of business. Close co-operation is necessary in order to secure the highest efficiency among operators. The managers of a company must take interest in the work of their operators, and not hesitate to show appreciation of their service.

Telephone Valuations.

On Thursday morning parallel sessions were held by the Engineers' Division and the Accountants' Division. In the meeting of the former section the first item on the program was an address on "Intangible Values," by J. C. Kelsey, of Chicago. Among the many interesting points brought out by this paper was the necessity for charging up to cost of ignorance, or cost of education, or cost of experience, the deficit that in all likelihood will be met with if a reasonable return is allowed to the investors in a telephone company, and if proper amounts are set aside as a reserve for depreciation. This point was graphically shown by means of charts that Mr. Kelsey produced. In the discussion which followed, Kempster B. Miller stated that this deficit should be regarded as part of the going value of establishing the business. F. A. Davis thought it might be ascribed to what he called "the establishment of trade account." E. W. Doty expressed the opinion that some means should be available by which a telephone company can secure a higher rate for a high grade of service and a lower rate for a poor class of service. Cost of ignorance should not be capitalized.

Kempster B. Miller, of Chicago, then read a paper on "Valuation of Physical Property." He laid particular stress upon the confusion that commonly results from failure to distinguish properly between cost and value. When cost is separated from value in point of time by a considerable interval the difference between the two is likely to be very great. The more closely the two are taken together the more nearly is cost equivalent to value, but it is only when they are taken at identically the same date that the cost is likely to be a fair measure of the value. Mr. Miller described at some length the most approved methods of valuation of utility property, and pointed out a number of what he called collateral costs, which commonly are referred to as indirect or overhead costs. It is impossible to apply the same percentage for these collateral costs in all cases, because this depends upon the conditions existing.

Uniform System of Accounts.

In the Accountants' Division the session opened with an explanatory address on the subject "The Accounts Prescribed by the Interstate Commerce Commission for Class C Companies," which was made by C. A. Bennett, auditor, Kansas City Home Telephone

Company. Mr. Bennett went into the subject in considerable detail, showing by means of charts the accounting forms prescribed by the Commission. Many questions were asked, which Mr. Bennett cleared up with the assistance of John W. Van Sant, examiner of accounts, of the Interstate Commerce Commission. Attention was called to the fact that telephone companies will soon have to furnish appraisals of their properties to the Commission, and, therefore, it was desirable that the method of making them and the manner of filing the items be thoroughly understood.

Mr. Van Sant then briefly addressed the meeting on the objects of the Interstate Commerce Commission in adopting a uniform system of accounts for telephone companies. A definite system, comprehensive and yet sufficiently elastic to meet the conditions of the various kinds of companies, was imperative in order to get at the facts. The Commission is anxious to furnish all detailed information desired relative to accounting. During the first year that the accounting system is to be put into effect a strict observance of it will probably not be required, in order that the companies may adjust their accounting methods to the system prescribed without hardship to the companies. This subject was continued further at the session held on Friday afternoon.

When the session on Thursday afternoon opened, nominations for directors of the Association were made by the Nominating Committee, and a few additional ones were made from the floor. Secretary MacKinnon then gave an illustrated address on "The Bell Qualified Toll-Line Contract." In this he spoke in detail of the negotiations that had been carried on between the independent telephone interests and officials of the Bell system. He explained the meaning of the various clauses of the contract, as originally proposed and as amended during the progress of the negotiations.

Telephone Regulation by Commissions.

Richard Yates, ex-governor of Illinois and member of the Illinois Public Utilities Commission, then made an address on "The Telephone Problem." He opened his address by explaining the work of the Illinois Commission in its regulation of telephone companies. A tentative draft of standards of telephone service has been prepared, and will be promulgated after another hearing. The aim of the Commission has been to secure harmony and co-operation between the telephone companies of the state. A needless duplication of telephone properties is not looked on with favor. The Commission has adopted the policy of preventing the entrance of a new company into a field already occupied, unless the service conditions absolutely require this. Ex-Governor Yates declared emphatically his opposition to ruinous competition, which is bound to ensue from such duplication, if the original company is giving adequate service. It has been found hard to convince the small companies, especially mutual lines, that state regulation is legitimate and desirable. He spoke of the need of securing adequate return on the utility's investment, to make it possible to secure the new capital continually needed for extensions.

State commissions are trying very hard to be fair to both utilities and public, despite criticisms. Regulation should be given a fair trial before attempts are made at municipal or government ownership. He explained why regulation should be by the state, and not by the city; the latter invariably represents the buyers of utility service only, whereas the state at large represents not only the users of the service but also the companies that supply it. In closing he replied to a number of criticisms on state regulation, particularly those made at the Mayors' Conference at Philadelphia last fall. He pointed out in this connection some of the falacies advanced at that time.

E. W. Doty, member of the Ohio Public Utilities Commission, then made an address entitled "Valuation of Telephone Properties." He declared that regulation will not have been proven a success unless it regulates in favor of the public, as well as of the utilities. He, himself, was in favor of municipal ownership, but not under present economic conditions. If ultimately it will be possible to secure, through municipal ownership, cheaper service, in the best sense of the word, then this should be done. Meanwhile, however, the utilities need not fear municipal ownership, if they give good service at reasonable rates.

Taking up conditions in Ohio, he discussed at length the famous order No. 176, requiring the filing with the Commission of valuations by all utility companies. He discussed the matter of depreciation as affecting valuations. The methods commonly used, of figuring depreciation on the straight-line basis, or by means of tables, are not satisfactory, because it is only by actual examination of the property that its condition can be ascertained. Much figuring of depreciation has been overdone; this was illustrated by some telephone and telegraph lines in the city of Cleveland that have been in service for periods of from 28 to 40 years, and on account of excellent maintenance are still in serviceable condition, although theoretically their depreciated value would be practically nil. If a property is well maintained, depreciation should be small.

One of the big problems in the utility business is to get an exact determination on a fair basis of the value of the utilities. The public ought to pay a reasonable return on value, not only of the physical property, but also of the brains in the utility business. One important feature brought out by the appraisal of Ohio utilities has been in teaching them exactly what their business is worth. Many of them had absolutely no knowledge of some of the most vital features of their business connected with the actual investment therein. Another feature is that it gives the public actual knowledge of the utility business and the many problems involved in it. If the public knows the utility company is well managed and knows that it is giving good service, it will not hesitate to purchase its securities. Referring to the heavy taxation of utility companies Mr. Doty stated that Ohio utilities last year paid nearly $19,000,000 in indirect taxes. He believed that the magnitude of this item would be brought home to the public if there were added to the rates charged a certain item to cover taxes, such as is done now in the federal emergency war tax.

Chairman McIntyre, of the Ontario Railway Commission, made a brief address, showing that commission regulation in Canada has been based on many valuable data and experiences obtained from this country. In all utility regulation the principle of compromise must be recognized. Enterprise must be encouraged and the initiative spirit maintained.

Unit Costs and Depreciation.

On Friday morning the session opened as a joint meeting of the Engineering and Accountants' divisions. W. F. Sloan, Madison, Wis., presented a paper entitled "Unit Costs." He reviewed the theories and practices in regard to appraisal of utility properties. The investment theory lays stress on unit prices for material and labor. The reproduction theory applies such unit prices as are believed to represent the cost of reproducing the property at the time of appraisal. In adopting a system of unit costs it is possible to take either the present prevailing price, or an average price, ranging for a period of a few preceding years. Both these give practically the same results, because fluctuations in individual items are largely counterbalanced. As a general rule, only one method should be used, and not a combination. Mr. Sloan discussed the elements that affect unit costs, among which are the size of the utility, the density of its distribution system, etc.

An address on "Depreciation" was made by E. C. Hurd, Lincoln, Neb. The various definitions usually given for depreciation were reviewed, and the importance of considering the subject was pointed out. This is a matter that is of vital interest, as has been recognized by state regulatory commissions. Mr. Hurd described the various methods by which depreciation is figured. He described the difference between depreciation and maintenance, but these were shown to be closely related. In closing, he showed that, although a better knowledge of depreciation now exists, much further study is being made on the subject. The matter was discussed by R. E. McDonald, Kansas City, Mo., who thought that much of the demand for valuations has been stirred up by politicians to stimulate political ambitions. If the proper purpose of making valuations is to secure public information, then the valuation determined should be made public and used to educate the public.

Election of Directors and Officers.

The report of the tellers on the election of the directors of the Association for the ensuing year was then presented, and there were declared elected the following: Terry W. Allen, Jackson, Tenn.; S. G. McMeen, Columbus, O.; W. Roy McCanne, Rochester, N. Y.; C. Y. McVey, Cleveland, O.; N. G. Hunter, Wabash, Ind.; W. C. Handlan, Wheeling, W. Va.; J. B. Earle, Waco, Texas; P. C. Holdoegel, Rockwell City, Iowa; F. B. MacKinnon, Washington, D. C.; H. D. Critchfield, Chicago; A. F. Adams, Kansas City, Mo.; C. E. Tarte, Grand Rapids, Mich.; A. G. Bean Elyria, O.; L. D. Kellogg, Chicago; H. B. McMeal, Chicago; L. E. Hurtz, Lincoln, Neb.; S. W. Harper, Pittsburgh, Pa.

The new Board of Directors had already had a meeting and chosen as officers for the ensuing year:

President—C. Y. McVey, Cleveland, O.

Vice-president—Terry W. Allen, Jackson, Tenn.

Secretary-treasurer—F. B. MacKinnon, Washington, D. C.

Executive Committee—C. Y. McVey, F. B. MacKinnon, H. B. McMeal, T. W. Allen, W. Roy McCanne.

Finance Committee—S. G. McMeen, N. G. Hunter, C. E. Tarte, L. D. Kellogg, A. F. Adams.

Resolutions.

Manford Savage, chairman of the Resolutions Committee, presented the report on this subject, and among the resolutions adopted were the following: Approval of the belief that the most efficient and satisfactory service to the people can be given by locally owned and operated companies connected up on equal terms with all toll lines under governmental and state regulation; that governmental regulation should aim to secure good service at the lowest rates consistent with a fair return on investment, and that unnecessary technical and burdensome requirements be eliminated; recommendation that state public utility commissioners be elected by popular ballot for a term of ten years, and that no commissioner shall hold any other office nor be a candidate therefor during his term, nor for two years after the expiration thereof; that the Association approve of the organization of a telephone security corporation, as has been proposed by reliable and responsible independent telephone men; that efforts be made to unite all independent telephone interests, and particularly that the Independent Telephone Association of America be urged to consolidate with the National Independent Telephone Association.

Interstate Accounts.

John W. Van Sant, of the accounting division of the Interstate Commerce Commission, Washington, D. C., then explained the system of accounting prescribed by the Commission for interstate telephone companies. These came under the jurisdiction of the Commission in July, 1910, and at the present time there are included about 50 class A, 200 class B, 2,000 class C, and about 8,000 companies in other classifications. The blank forms for the accounting of classes A and B will soon be ready, and the reports required should be made within two months. The smaller companies in the other classes will be given proper notice in due time.

At the final session on Friday afternoon, which was devoted to discussions by accountants, questions on this matter were discussed by C. J. Queen, E. H. Hanna, Le Roy Parker, A. L. Staderman, A. B. Parlett, and several others.

Exhibits.

As usual, very extensive exhibits were made by manufacturers of telephone equipment and supplies. These covered the entire 17th floor of the hotel. Among the companies exhibiting were the following: Adsit General Electric Company, American Electric Company, American Telephone Fire Alarm Company, Julius Andrae & Sons Company, Automatic Electric Company, Automatic Time Stamp Company, Frank B. Cook Company, Cox Lightning Arrester Company, Cracraft-Leich Electric Company, Delta Electric Company, Electric Storage Battery Company, Everstick Anchor Company, Garford Manufacturing Company, Gund Manufacturing Company, Holtzer-Cabot Electric Company, Illinois Electric Company, Indiana Steel & Wire Company, International Harvester Company, H. W. Johns-Manville Company, Kellogg Switchboard & Supply Company, Mathias Klein & Sons, Manhattan Electrical Supply Company, W. N. Matthews & Brother, Monarch Telephone Manufacturing Company, National Carbon Company, Naugle Pole & Tie Company, Nungesser Carbon & Battery Company, Page & Hill Company, Rand Company, Reliable Electric Company, John A. Roebling's Sons Company, Standard Underground Cable Company, Stewart Brothers, Stromberg-Carlson Telephone Manufacturing Company, Swedish-American Telephone Manufacturing Company, Thompson-Levering Company, Utilities Indemnity Exchange, Valentine-Clark Company, White Company.

English Electrical Meetings.

The Manchester Section of the English Institution of Electrical Engineers held a meeting in Liverpool on February 9. Prof. E. W. Marchant read a paper on conditions affecting the variations in strength of wireless signals. Appliances used in connection with the measurments of signal strength were inspected and demonstrations given with high-frequency currents, including high-power Poulsen arc and resonance experiments with long solenoids, and with the oscillograph.

Electric Steel-Making Furnaces.

Before the same Section, on January 26, T. D. Robertson read a paper describing representative types of electric steel-making furnaces—the Stassano. Héroult and Kjellin—from which had been developed the three main classes now in use. Broadly he divided the furnaces into two classes—induction and arc—the latter being subdivided into arc radiation and arc conduction types. Mr. Robertson said that much had been written and many data published concerning the power consumed by electric furnaces in making a ton of steel. Many of the published figures were not trustworthy, very often referring to accidental or quite exceptional performances of the furnace. If it were possible to get comparative figures from different furnaces of the same size, using the same raw materials, and manufacturing the same products, the question of the relative merits of the different types of furnace from the point of view of energy consumption could be settled. As far as one could ascertain there was really not much difference in the actual power needed when doing the same work in the different types of the better known furnaces; and in fact when deciding on which type of furnace to install, the questions of the initial cost of the plant, its suitability for running off existing power supplies, the cost of the repairs to the furnace, and the ease with which

these could be carried out, were all points which were as important as the question of low power consumption. Much depended upon the kind of raw materials used, upon the process employed, and upon the quality desired in the final product. For example, it was quite possible by "killing" the steel with silicon and manganese (as was done in the open-hearth furnace) to produce a steel in less time and using less energy than when employing a deoxidizing process which had been described to the meeting, but at the same time the steel produced, although showing a satisfactory chemical analysis, was not so good under actual working tests as was the steel upon which more time was spent and more power used for deoxidation in the best manner. Naturally the purpose for which the steel was to be used determined the nature of the refining process which ought to be employed. Mild steel suitable for steel castings could be produced much more cheaply than the highest qualities of tool and alloy steels. Further, the size of a furnace had an important bearing upon the energy consumption, as of course the larger furnaces had less surface from which to radiate heat, compared with the weight of metal which they held, than those of small capacity. However, when melting cōld scrap, using two slags, and refining to a first-class quality, the approximate energy consumption decreased from 850 kilowatt-hours per ton, in the case of a two-ton furnace, to 700 kilowatt-hours per ton, in the case of a five-ton furnace.

The London meeting of the Institution of Electrical Engineers on January 28 heard Prof. A. Gray deliver the annual Kelvin lecture on "Lord Kelvin's Work on Gyrostatics." The lecture was repeated at Birmingham on the following night. Other subjects for the remainder of the present session include: Polyphase commutator machines (N. Shuttleworth); electricity as applied to mining (C. P. Sparks); electric cooking, mainly from the consumer's point of view (W. R. Cooper); Bombay hydroelectric scheme (A. Dickinson); and power supply to the Rand mines (J. H. Rider).

English Electric Vehicle Committee.

At its January meeting the secretary reported that the sales of publicity mail cards had been comparatively small and the hope was expressed that the various undertakings would not fail to make use of this very convenient method of setting forth the advantages of the electric vehicle. The electricity undertakings associated with the committee are to be asked to indicate the required number of charging station signs (the design was illustrated in our pages a few weeks ago) so that arrangements may be made for their production by one manufacturer. The committee received intimation from the Tungsten Lamp Association that it had appointed a sub-committee to go into the standardization of incandescent lamps for electrics, in conference with that committee. Purchasers of electrics are recommended to insist upon having standard wheel rims for solid tires according to sizes standardized by the Engineering Standards Committee at the instance of the Society of Motor Manufacturers and Traders.

Law Regulating Minimum and Maximum Rates Asked For.

The Committee on Public Lighting of the Massachusetts Legislature is holding hearings on a bill to limit the minimum price of electricity furnished by a public service corporation to 5 per cent above cost of production and distribution, and the maximum price to 25 per cent above such cost, the Gas and Electric Light Commission to determine the cost from an examination of the company's books. The Power League of New England is the petitioner for this legislation. This organization is made up of representatives of electrical and steam workers' unions, and of manufacturers of certain classes of electrical apparatus. The sponsor for the organization is Ernest Stevens, of Somerville, Mass., engineer of a hotel power plant in Boston.

At a hearing on February 5, Mr. Stevens argued that a public service company, under state franchise, has no right to discriminate between customers in rates. Such companies should not be allowed to sell their product to certain users at less than cost, and impose an unjust burden on the small consumer.

Thomas W. Byrne, an electrical manufacturer and contractor, charged lighting companies with discriminating against 90 per cent of their customers (the smaller users of light and power) to the advantage of 10 per cent. He held that rates are often based on what the traffic will bear, the charges being lower in those cases where there is possibility of private plants being installed. This mode of charging, he said, is against the public interest and contrary to law.

Mr. Byrne claimed that a two-cent rate to a large department store as against 10 cents to the small householder was unjust and discriminatory. He estimated the cost of supplying current in smaller units at about 25 per cent more than in large blocks.

The National Electric Light Association's rate report on the policy of basing rates in part on the probability of the installation of competitive service, was cited.

Mr. Byrne alluded to the generally accepted principle held by regulating commissions, that a company is entitled to a fair return on its investment, and pointed out that each division of the service should be rewarded by a fair return, on even terms. Massachusetts has never valued the property of electric companies, but takes their sworn statement in matters of rate adjustment. An appropriation by the State for the valuation of the properties was urged.

Mr. Byrne pointed out the value of informal conferences with the regulating commission, on matters in dispute, and believed the Massachusetts Commission should offer its services rather than wait for formal complaints.

It was recommended that the bill be broadened in scope so as to require the Public Service Commission to report (1) what difference in rates should be charged for light and for power; (2) what difference for a long and a short-term contract; (3) its opinion as to the profit on each class of lighting, assuming a uniform rate based on cost of service; (4) the difference between rates on account of quantity; (5) does the Commission indorse the expressed views of the National Electric Light Association? (6) does it approve of the issue of securities after valuation? (7) that the Commission analyse the Wisconsin Commission's rulings.

Electric River Gauging.

To show the way in which rivers are gauged, that is, how the volume of running streams is measured by the United States Geological Survey, the exhibit maintained by the Survey at the Panama-Pacific Exposition, in San Francisco, will include a display of automatic gauges, run by electricity, which record the fluctuating heights of water of an artificial river—one flowing through a tank. The work of measuring the flow of the various streams of the United States every day in the year and some of them several times a day affords an invaluable basis for the study of our water resources. Upon the data thus obtained engineers depend in working out plans of water-power development, irrigation, drainage—in fact, every project in which running water is a factor.

Central Stations of New Mexico to Organize.

A meeting of the representatives of central stations in New Mexico will be held in Albuquerque, February 15 and 16, for the purpose of forming a state organization. The move is being started by A. F. Van Deinse, of Albuquerque, and C. M. Einhart, of Roswell.

OPERATING RESULTS IN A HYDROELECTRIC PLANT.

Test and Cost Data from a Recent Engineering Investigation.

Complete operating data and overall costs, including fixed charges, are of interest in connection with the study of hydroelectric-plant service economy. Many steam-plant costs have been printed in the technical press, but similar data from water-power stations are seldom seen. In the following paragraphs are given the essential results of a test and cost investigation made last year in a station of 4,000 kilowatts rating, the plant being designed to utilize water flowing from a large storage reservoir primarily built for domestic and industrial service.

Reservoir and Dam.

The reservoir has a capacity of 65 billion gallons, a total water area of 6.5 square miles, and an average depth of 48 feet. The dam was built across a valley at the north end of the reservoir and is mainly of granite rubble masonry, 944 feet long, 114 feet high, and 25 feet thick at full reservoir level. The waste weir is 452 feet long.

Penstocks.

Four 48-inch cast-iron pipes passing through the dam lead from circular vertical wells into the power house, which is located at the toe of the dam. Two wells are provided for each pipe, with two 2.5-by-6-feet sluice gates at 33.5 feet and 65.5 feet below high water, affording openings from the up-stream to the down-stream well. Water is admitted to each of the up-stream wells through six ports in the masonry, each 8 feet high and 2.5 feet wide.

Generating Plant.

Each penstock discharges into an S. Morgan Smith horizontal turbine equipped with a type G, Lombard governor. Each turbine was guaranteed to develop 1,200 horsepower at 400 revolutions per minute under 90 feet net head. Each turbine is direct-connected to a 1,000-kilowatt, three-phase, 60-cycle, 13,800-volt generator. The exciter equipment consists of a 110-horsepower S. Morgan Smith turbine and a 90-horsepower Holyoke turbine. Each drives a 60-horsepower Westinghouse, 125-volt generator running at 1,000 revolutions per minute. Motor-driven pumps in the well installation and an electrically operated crane in the power house are also supplied with energy by the exciters.

Water Measurements.

The flow of water through the turbines is measured by four Venturi meters in the penstocks. Each meter has a 40-inch throat 10 feet, 4 inches long and an upstream pressure chamber, the pressure being transmitted to the recording instruments in the power house by 0.75-inch brass piping. The recording instruments indicate the rate of flow in million gallons per 24 hours and also register the total flow through each meter. The Venturi meter of Unit No. 4 recorded both the flow of the meter through the main turbine and the exciter turbine, thus making it impossible to directly determine the rate of flow through Unit No. 4. Curves were plotted with millions of gallons per 24 hours as ordinates and gate openings as abscissae, with Units No. 3 and No. 4 running only. It was assumed that since these units were of the same rating and design and since the exciter turbine was running at practically constant gate opening, the difference between the ordinates of these curves for a particular gate would give the rate of flow through the exciter. In order to attain a more nearly correct value for this rate of flow, the average of differences of ordinates was taken for several gate openings. This was found to be 8,500,000 gallons per 24 hours.

EFFICIENCY DATA—1,000-KILOWATT GENERATING UNITS.

Cubic feet per second	Per cent of load	Efficiency of unit, per cent	Efficiency of generator, per cent	Efficiency of turbine, per cent	Average Turbine Efficiency.	Turbine No.
73	43.0	70.5	91.0	77.4		
122	83.0	81.3	94.8	85.8		
138	94.0	81.0	95.2	85.2	83.1	1
155	103.5	80.0	95.4	84.0		
73	41.5	66.5	90.7	73.4		
122	76.0	77.5	94.5	82.0		
138	86.5	79.3	94.9	83.6	80.6	2
155	96.5	79.5	95.2	83.5		
73	46.5	72.0	91.8	79.4		
122	81.0	79.3	94.7	83.8		
138	91.0	80.0	95.0	84.2	82.8	3
155	101.0	79.7	95.3	83.7		
73	46.5	72.0	91.8	78.5		
122	83.0	81.0	94.8	85.4		
138	93.5	82.0	95.2	86.1	83.7	4
155	103.7	81.0	95.4	84.9		

Efficiency Tests of Generating Units.

Efficiency tests were made on each unit and the results are tabulated below. The Venturi meters were found by other tests to be accurate within 2 per cent when registering between 48,000,000 and 110,000,000 gallons per 24 hours. Below 30,000,000 gallons the meters were not sufficiently correct for reliance, so that data calculated upon one-eighth gate opening are not given. In making the runs the generator excitation was regulated to give approximately unity power-factor at full load. This excitation was kept constant throughout the run. The makers of the wheels guaranteed that when rotating at 400 revolutions per minute under a net head of 90 feet, and when discharging respectively 73, 122, 138 and 155 cubic feet per second, would give an average efficiency of 82 per cent.

The second turbine was found by independent test to be slightly below its guarantee on average efficiency, but the other exceeded their guarantee. The turbines were guaranteed to develop 1,200 horsepower, presumably at maximum efficiency. The maximum efficiency and output of each turbine as tested were as follows:

Turbine No.	Maximum efficiency, per cent	Horsepower output
1	85.8	1320
2	83.6	1210
3	84.2	1300
4	86.1	1310

All the turbines therefore delivered the guaranteed output.

Costs of Operating.

The first cost of the installation was $227,474, itemized as follows:

Station building	$113,786
Foundations of turbines and generators	7,883
Total station cost	$121,769
Turbines and generators	$ 70,574
Labor and materials	5,043
Penstocks and valves	1,375
Venturi meters	6,212
Traveling crane	2,500
Total equipment	$ 99,704
Lightning arresters and outgoing line equipment	6,001
Total	$227,474

FIXED CHARGES AND OPERATING EXPENSES (YEARLY).

Labor, 1 electrical engineer, 1 operator, 2 helpers, 1 helper part time	$ 5,531
Fuel for heating building	86
Repairs and appliances	354
Oil and waste	87
Small supplies	262
Taxes	2,675
Interest at 6 per cent	11,374
Depreciation, station and machinery, 4 per cent	4,475
Depreciation on transmission equipment, 2 per cent	120
Total	$24,964

Daily output in kilowatt-hours	18,000
Total cost per kilwoatt-hour	0.46 cent
Selling price per kilowatt-hour	0.53 cent
Net earnings per kilowatt-hour	0.68 cent

Tungsten Ores in 1914.

The production of tungsten ores in the United States during 1914 is estimated as equivalent to about 990 short tons carrying 60 per cent of tungsten trioxide. This output is the smallest since 1908, when only 671 tons was produced. In 1913 the production was 1,537 tons.

Brightly Lighted Outdoor Rink.

The popular Canadian sport of curling has invaded the United States and claimed enthusiastic devotees. At Concord, Mass., a fine rink has been constructed on the estate of a wealthy resident and provided with electric illumination, so that the sport can be engaged in at night.

The rink is 160 feet long and 50 feet wide, forming two alleys, and was constructed by levelling the ground, depositing six inches of clay and on that six inches of white Vermont marble dust. The area was then flooded with water, the water being allowed slowly to saturate the earth and clay and marble deposits, and freeze solidly. After that, a six-inch coating of ice was formed, by further flooding.

The use of the marble dust was to provide the least possible absorbing element for the sun's rays as they penetrate the ice.

A solid sheet of ice having formed, the rink will remain frozen all winter, only requiring occasional levelling by the use of an ice plane.

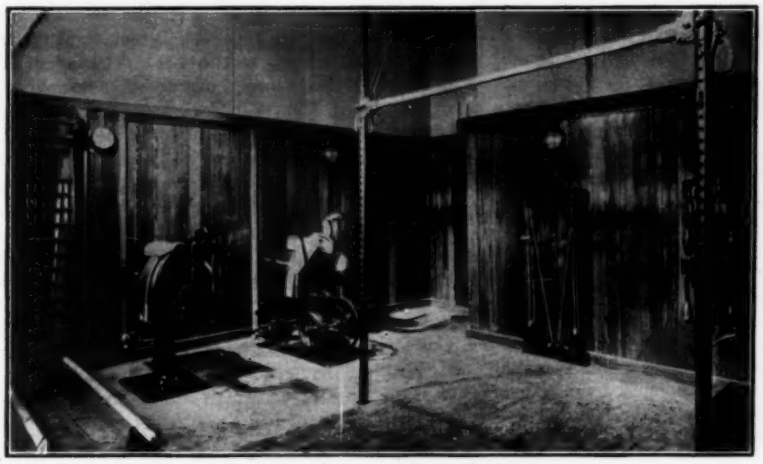
The Concord rink, which is used by an organization known as the Concord Curling Club, is lighted by means of 16 Mazda lamps installed on two lines of stay wires extending the length of the rink, about 35 feet apart, and secured to stout poles at either end. Four 250-watt lamps at either end are installed, two on the posts and two on the suspension wires about 20 feet distant, while the eight lamps in the interval are of 150 watts. The larger units provide specially bright illumination over the two goals.

Illumination of Outdoor Curling Rink.

All the units are provided with white-enameled corrugated metal reflectors about 20 inches in diameter, the lamps hanging about 15 feet above the surface of the ice. Two intersecting guy wires connect the lines of lamps and are made fast to poles on either side of the rink.

Electric Gymnasium on Shipboard.

The uses of electric motors in the well equipped gymnasiums on the steamers *Andania* and *Alannia* of the Cunard Line, which regularly ply between Boston or Portland, Me., and English ports, suggest applications that could readily be made in public and in private gymnasiums on land.



Electric Gymnasium on Board Ship.

Two "riding horses" are among the apparatus for physical development and exercise on these fine steamers. They are built of steel, the seat being shaped to form the contour of a horse's back, and each "horse" is provided with a saddle and stirrups, and reins attached to a stationary "head."

The framework forming the horse's back in each case is supported by a moving mechanism which raises and lowers the framework, giving the motion, in one case, of a smart trot, and in the other, of a lope and canter. The mechanism of each riding horse is operated by a small motor placed on the floor in one instance, and within the frame in the other. The motors are run on direct current, and each is provided with a variable-speed starting box conveniently located on the wall behind, in reach of the gymnasium instructor. The speed of the "trotting" horse is further controlled, for easy or violent exercise as may be desired, by a lever at the rider's right hand; while the other horse is given a long loping gait or a "rough-riding gallop" by the throw of a lever which shifts the driving mechanism from one set of gears to another.

A rapid-action massaging apparatus is another motor-driven machine which furnishes beneficial treatment to voyagers on these steamers.

Annual Report of Bureau of Mines.

In his annual report submitted to the Secretary of the Interior, Joseph A. Holmes director of the Bureau of Mines, reviews the investigations made by the Bureau to safeguard miners from electrical accidents. Dr. Holmes makes the declaration that not only have many men been killed or injured from what are believed to be unnecessary electrical accidents, but indirectly electrical apparatus has been responsible for mine explosions and mine fires that have extensively destroyed both life and property.

He further says that, through the activity of the Bureau in calling attention to dangers heretofore unappreciated in the use of electrical machinery, manufacturers have devised safer types of apparatus and states have enacted stricter laws governing electrical installations.

Much attention has been paid to the proper construction and use of electric and other safety lamps. Tests have been made to ascertain the comparative merits of different types of safety lamps, including their usefulness in furnishing light to miners, their relative safety, and their value in indicating the presence of explosive gas. The well defined principles that govern the mechanical construction of a modern safety lamp have

been largely exploited by European manufacturers and covered by patents in this country. During the present year some of these patents have expired and in consequence American lamp manufacturers and lamp agencies have been inspired to develop new models. Already an improved safety lamp of American manufacture has appeared, and samples of others have been received by the Bureau for examination and critioism. The bureau has studied all types of safety lamps on the market and as a result has prepared a schedule of official tests to be used in establishing a list of permissible safety lamps for use in gaseous mines.

At the beginning of the year the Bureau's requirements for testing explosion-proof motors had been prepared and published. This work was necessary because no successful explosion-proof motors had been developed in the United States. During the year only one motor was submitted for test, but this machine passed the tests successfully. It is believed that the Bureau's approval will stimulate other manufacturers to renewed activity in producing such motors. In the investigation of the ignition of coal dust by electric flashes, valuable results have been obtained. Coal-dust ignitions have been obtained under practical underground conditions with currents of surprisingly low voltage. The danger of dust explosions being started by such currents has been shown, but the work needs to be continued to determine the extent of the danger and how it may be nullified.

Lighting Features of a Boston Department Store.

The Boston department store of William Filene's Sons Company is said to have been the first in the United States to make use of the gas-filled incandescent lamp. When the company's new building was erected, about two years ago, it was lighted throughout with tungsten lamps. The present installation consists entirely of gas-filled lamps.

The first floor is lighted by means of 750-watt lamps, installed singly in large bronze electroliers, stem upward, and with a white-enameled metal reflector under each unit, replacing X-ray reflectors which were at first installed.

The attempt to install gas-filled lamps with stem downwards was discontinued.

Other floors than the ground floor and the seventh floor, on which the offices are located, are lighted by 500-watt lamps installed in bronze electroliers. The latter are pendent on four bronze chains, about three feet from the ceiling. The spacing of the lighting units is uniformly about 27 feet in either direction.

In the offices, on the seventh floor, 200-watt lamps are installed, while in the basements, over stairways and hallways, 100-watt argon-filled lamps are employed, in bell glass shades set close to the ceiling.

The engineer of the Filene Company, David A. Chapman, made a special specification on wire to be used for drop cord for all indirect lighting in the store. It consists of stranded asbestos-wound fireproofed silk-covered cord. Tests indicated the average skin temperature of the 750 and 500-watt lamps installed to be about 400 degrees Fahrenheit; hence the necessity of safeguarding the cords.

A feature of the installation of lamps nearest a balcony above the first floor, with floor level about five feet below the lamps themselves, is a double or two-ply conical wire screen, to shroud each lamp from the view of people on the balcony. This screen was devised by Mr. Chapman and consists of two layers of pearl-gray steel wire, one over the other, with clamp to fasten the screen to the neck of the bulb. The usual brass-wire screen of single ply was found to leak light, while the new device cuts off practically all the light rays and forms an adequate protection to the eye.

Heretofore the store's show-window lighting was effected by an installation of six or eight 100-watt Mazda lamps per window, set in a trough reflector above the window and close to the street wall. A 750-watt gas-filled lamp was also operated in a position in the center of the ceiling of the show window, recessed and shielded from view by a hood.

With the substitution of argon-filled lamps of 100 watts each, in the same trough reflector, the auxiliary units have been dispensed with, since the new lamps provide ample illumination and also lend themselves to a more even and effective light distribution over the show-window area.

Production of Copper in 1914.

The copper production of the United States in 1914 shows a marked decrease from that of 1913, according to figures and estimates collected by B. S. Butler, of the United States Geological Survey. Reports have been received from all plants known to produce blister copper from domestic ores and refined copper. At an average price of about 13.5 cents a pound, the 1914 output has a value of $152,400,000, compared with $189,795,000 for the 1913 output. The large decrease in production in 1914 was due to curtailment of production during the later part of the year on account of the reduction in tonnage exported to Europe.

The figures showing smelter production from domestic ores represent the actual production of most of the companies for 11 months and an estimate of the December output. The November figures for a few companies were not available, and these companies furnished estimates for the last two months of the year. According to the statistics and estimates received, the output of blister and Lake copper was 1,129,000,000 pounds in 1914, against 1,224,484,000 pounds in 1913.

The statistics and estimates indicate that the output of refined copper from primary sources, domestic and foreign, for 1914 was 1,493,000,000 pounds, compared with 1,615,067,000 pounds during the year 1913.

The imports for the first 11 months of 1914 amounted to 187,433,676 pounds, and the copper contents of ore matte and regulus amounted to 97,348,866 pounds, a total import of 284,782,542 pounds. This compares with an import for the 12 months of 1913 of 409,560,954 pounds.

The exports for the first 11 months of 1914 amounted to 780,048,777 pounds, compared with an export for the 12 months of 1913 of 926,441,142 pounds.

At the beginning of 1914 there was about 90,000,000 pounds of refined copper in stock in the United States. This added to the refinery production gives a total available supply of about 1,583,000,000 pounds of refined copper. On subtracting the export from this, with an estimate for December, it is apparent that the supply available for domestic consumption is materially below the 812,000,000 pounds of 1913, without taking account of stocks held at the close of the year.

The average price of copper for 1914 showed a decrease from that of the preceding year, being about 13.5 cents a pound, compared with 15.5 cents in 1913. After the outbreak of the European war copper sold considerably below the yearly average, but toward the close of the year the price showed notable improvement.

Arizona continued in first place among the copper-producing States, but had a notably decreased output. The blister-copper production for 1914 will probably not exceed 380,000,000 pounds, compared with 404,000,000 pounds for 1913.

The production from Montana was the smallest for many years and probably did not greatly exceed 206,000,000 pounds. In 1913 Montana produced 285,700,000 pounds.

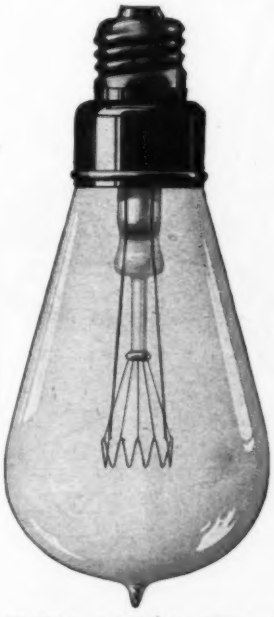
Michigan, with a production of about 160,000,000 pounds, made a slight gain over the 155,700,000 pounds produced in 1913, but was still much below the normal output for the State.

Utah shows but little change from the 148,000,000 pounds produced in 1913.

New Electrical and Mechanical Appliances

The New Hundred-Watt Gas-Filled Mazda Lamp.

Announcement is made that the improved construction by gas-filling the bulb, which has been applied to Mazda tungsten lamps during the last year and a half and which has resulted in high-candlepower, high-efficiency units, has been extended to include the 100-watt multiple lamp. In construction and appearance, the new lamp closely resembles the larger Mazda lamps with which the electrical trade is by this time familiar, but it is understood that the new lamp is filled with argon instead of nitrogen gas.

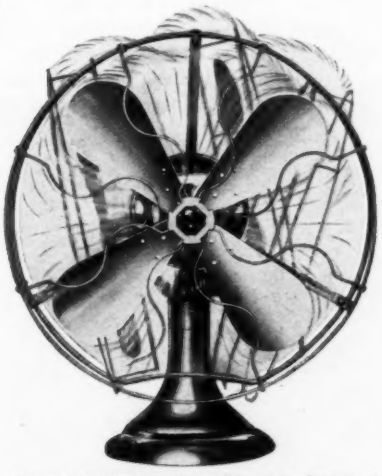


New 100-Watt Gas-Filled Mazda Lamp, One-Half Actual Size.

The lamp is supplied in a small bulb, smaller in fact by eleven-sixteenths of an inch than the bulb of the old 100-watt tungsten lamp. However, the light-center length has remained unchanged so that in substituting the new lamp for the old no change need be made in reflector equipment. Because of the method of mounting the filament, the lamp should be burned only in the vertical pendent position with tip down.

The new lamp operates at a remarkably high efficiency, 0.80 watt per candle as against 0.95 watt per candle of the old 100-watt lamp. The gain in candlepower is 19 per cent, the rating being 125 candlepower compared with 105. In addition to the efficiency advantage, there is the advantage of a color quality of the light, closely approaching that of the present high-wattage gas-filled lamps. This is due to the fact that the filament temperature of these lamps is somewhere nearly equal.

This announcement means more than the simple adding of a new lamp to the Mazda line, for it marks the attainment of a new lower limit in wattage for lamps embodying the more recent improvements, especially gas-filling the bulb, which a few months ago were more or less generally thought to be applicable only in lamps of 750 watts and over.



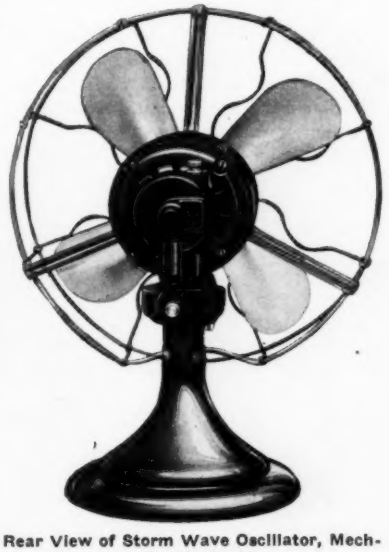
Unique Oscillating Fan, Showing Some of Its Positions.

A New Departure in Electric-Fan Construction.

Patents have recently been issued to two Chicago inventors covering entirely new and unique principles in directing air by means of electric fans. The accompanying illustrations show two views of the ordinary desk-type fan equipped with special oscillating mechanism which permits the fan to be shifted in horizontal and vertical planes, thus directing currents of air in practically all directions.

A general idea of the construction can be obtained from the first view, showing the mechanism with the casing removed. The under side of the fan motor is provided with a lug that is pivotally engaged in a bifurcated head of a rotating shaft extending up through the base of the fan, thus allowing the motor to be tilted up or down as desired.

As will be seen in the illustrations, the the upper section of the base of the fan is made as a sleeve, provided with an integral transversely disposed annular flange or track concentrically arranged with respect to the shaft on which it can revolve. This annular flange is of wave-like construction with the crowns of the wave diametrically opposite the depressions. Teeth are cut in the rim of this flange which mesh with a pinion driven by the fan motor through gearing.



Rear View of Storm Wave Oscillator, Mechanism Inclosed.

The mechanism for operating the pinion comprises a worm on the armature shaft of the motor which engages with a gear on a small shaft placed perpendicular to the motor shaft. At the lower end of this small shaft is the pinion which engages with the teeth of the wave-like flange. Set screws are provided so that the various moving parts can be locked or released as desired.

With the combination of gears and set screws provided, six different movements of the fan can be obtained. For instance, if the sleeve is locked to the rotating shaft and the gearing be engaged the

fan, when in operation, will turn about a vertical axis. As the pinion travels along the rack, the fan is tilted up and down in a vertical position as the pinion ascends or descends the wave portions of the rack. Thus, if a fan of this construction is placed in the center of a room, it will direct its air currents entirely around the room in a horizontal plane, and at the same time up and down in a vertical plane.

A second movement may be obtained by releasing the sleeve and securing the shaft against rotation. If then the motor is set in operation, the pinion will rotate, but since the shaft is fixed and the sleeve is free to rotate the pinion will only cause the sleeve to move. As the wave-like construction of the rack passes the pinion, the fan will be tilted up and down in a vertical plane.

If the gear meshing with the armature shaft is released, the fan when operating will remain stationary, so far as movement with respect to the base is concerned. However, the fan may be set at any angular position with respect to the horizontal by shifting the sleeve so that the pinion will rest at any point intermediate of the crests and depressions of the flange.

By means of other adjustments the fan can be operated as an ordinary oscillating fan; as an oscillating fan moving in a diagonal plane; and as an oscillating fan tilted up and down as it oscillates.

The fans of this type will be made in the usual styles and sizes and should find a wide application where it is desired to direct air in many directions.

The Allied Electric Company, 105 N. Clark Street, Chicago, will manufacture and market these fans in this country, while the export business will be handled by the Storm Wave Fan Company, of the same address.

Peerless Variable-Speed Portable Electric Power Equipment.

The Peerless portable power outfit, manufactured by the United Manufacturing Company, Kansas City, Mo., has been developed to meet the demand for a flexible, variable-speed, portable power drive for all purposes where convenience, economy and speed are essential factors. This machine consists of a revolving tool-bit socket mounted in the end of a flexible shaft and driven by a motor mounted on an iron base set on swivel casters. The variable-speed friction drive gives this portable tool all the advantages of the modern drill press combined with those of the stationary grinder. In other words, it is adaptable to many kinds of work.

The motor and all mechanical parts are inclosed in a metal housing, as shown in Fig. 1. Handles attached to this housing make it easy to carry the machine on street cars and public conveyances. The motor can be furnished for either direct current or alternating current. Split couplings connect the flexible shaft and motor to the friction disks. An adjustment screw regulates the contact between the friction disk, the wear on the driving disk thus not interfering with the operation of the shaft. All bearings are made of high-speed bearing metal, and compression oil cups are used for lubrication. All parts are dowelled, permitting removal and replacement in perfect alinement.

Fig. 2 shows the outfit in use for removing scale and corrosion from ammonia condensing pipes. In this particular job two men were first employed and attempted to clean the pipes by hand. It required two weeks' time for them to clean two stands, consisting of 24 pipes. The same two men, with the outfit described, finished eight stands, or 96 pipes, in seven days, thus saving in labor cost alone twice the price of the machine on the one job. The demonstration was made at the plant of the Franklin Ice Cream Company, Kansas City, Mo. This is only a typical instance of the value of this equipment for places where labor economy and saving of time are a real object in any class of work to which it is adaptable.

Fig. 1.—Variable-Speed Portable Electric Power Outfit.

Fig. 2.—Portable Power Outfit in Use Removing Scale from Ammonia Pipes.

Foundry and rail grinding machines are made that are equipped with the Peerless flexible shaft, which can be kept in continuous operation without heating. The entire line of Peerless portable tools is simple in construction and adjustable to any requirements. The variable-speed sets are built in four sizes up to one horsepower, or larger to order.

Mysterious Electric Chair.

An original, mysterious and harmless, but most effective mirth-producer for the festivities connected with initiation ceremonies, for fun parlors, private or club parties, etc., has been developed in the form of a simple chair with electrically charged seat. The popular notion of an electric chair is a formidable apparatus with elaborate electrodes, strapping arrangements, etc., and such is the equipment in penal institutions where electrocution is the official form of capital punishment. Consequently, the electric chair illustrated herewith is a most innocent looking piece of furniture, not only to the uninitiated, but even to those who are aware that there is some mystery associated with it.

Odenwald Electric Chair.

The peculiar property of this chair is that when a person sits down upon it he suddenly finds it impossible to remain seated and therefore rises with extraordinary celerity. The secret of this phenomenon is in the ingenious and compactly arranged electrical equipment just below the unostentatious cane seat. There are no external circuit wires and the apparatus is entirely self-contained and automatic in

action. On being seated the circuit-closer operates and through the medium of a powerful induction coil or other device, the details of which the maker of the chair does not wish publicly disclosed, a lively electric charge is impressed on the seat of the innocent victim with harmless but rather amusing results.

This electric chair has been devised and placed on the market by John J. Odenwald, 1204 H Street N. W., Washington, D. C. Mr. Odenwald is an electrical contractor, who is also prepared to install his equipment to order in chairs sent to him so as to match exactly the furniture in use in lodge halls, club rooms, etc.

Mantel-Type Electric Radiators.

The old-time evenings by the fireplace with its crackling wood fire have given way before the advance of civilization and modern conveniences. After having discarded the log fire for the more convenient modern heating systems, the true comfort lover again has the pleasure of the fireplace available without its attendant discomforts by means of the most convenient form of heating—electric radiators.

A complete line of luminous radiators for use in the mantel place is being marketed by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. These radiators range in size from 15.5 by 18 inches to 30 by 30 inches, several artistic designs being available in each size. The radiators use from two to four luminous heating units each, each heating unit requiring 250 watts.

The radiators are adapted for intermittent service, being particularly useful for removing the chill before or after the regular heating system is in use. Their safety from danger of fire or fumes makes them ideal for nurseries, bath rooms, receptions halls and similar enclosures.

Each radiator consists of a handsomely finished ornamental front with polished copper reflector and two, three or four heating units, which are readily removable. The fireplace radiators are furnished in polished brass, antique brass, oxidized copper, or practically any electroplating finish desired. Bathroom radiators are finished only in polished nickel.

Two-Unit Luminous Radiator.

Submarines for Government.

Submarine L-8 will be constructed for the United States Navy at the Portsmouth Navy Yard, Kittery, Me. This will be the first submarine to be built by the Government at any of its navy yards.

In this and in submarine E-2 Edison batteries will be installed.

The Electric Boat Company, Quincy, Mass., has been awarded the contract for the construction of the largest seagoing submarine ever built in this country. Its displacement will be 1,000 tons, and it will cost the United States Government about $1,350,000.

Its battery equipment will enable the craft to travel under water more than 24 hours. Its radius of action will be 3,000 miles, its surface speed 20 knots an hour, and its speed submerged 11 knots an hour.

The Electric Boat Company will build three coast-defence submarines on the Pacific Coast and four at Bridgeport, Conn.

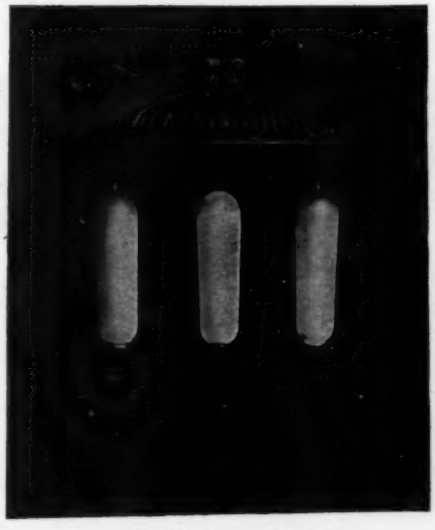
History and Personnel of Ward Leonard Electric Company.

One of the oldest electrical manufacturers in this country is the Ward Leonard Electric Company, of Bronxville, N. Y. The present organization of the company was formed by Mr. H. Ward Leonard in the midsummer of 1892, almost 23 years ago.

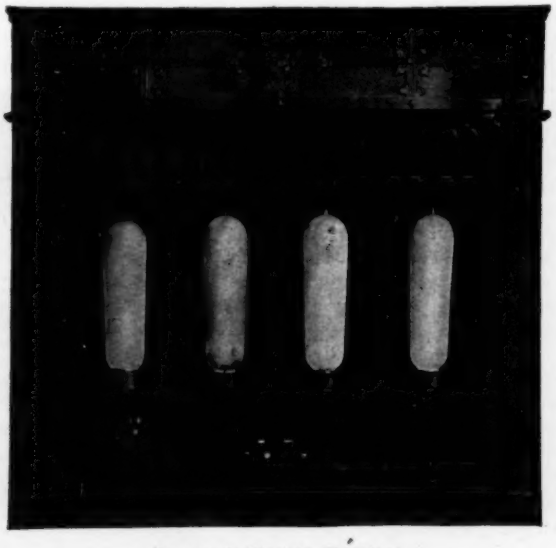
The company was organized for the purpose of manufacturing electric controlling devices, and has continued in this line ever since, being the oldest concern in the world today which has specialized in electric controlling devices of all kinds. It is this long experience in the manufacturing of automatic electric controlling devices which has made possible the Ward Leonard automatic controller for automobile lighting systems.

During the first few years of its existence the organization had factories in Bridgeport, Conn., and later in Hoboken, N. J., and in 1897 moved into the nucleus of its present plant in Bronxville, N. Y. Since that time the factory plant in Bronxville has been repeatedly increased, the last increase being in the form of an additional building put up a little over a year ago.

The Ward Leonard Company has

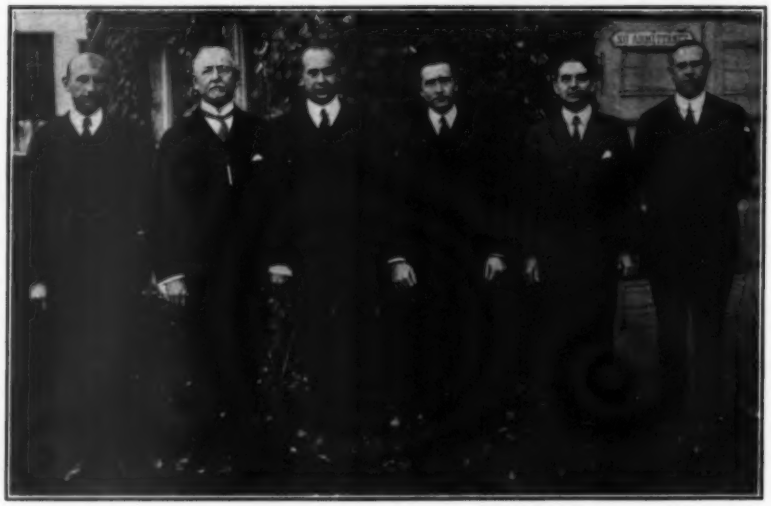


Three-Unit Mantel-Type Radiator.



Four-Unit Electric Fireplace.

manufactured and marketed the inventions of H. Ward Leonard and other engineers of the company during this period, the patents issued to Mr. Leonard alone totaling over 100. The company manufactured automobiles for a period of several years ending in 1903 during which time numerous patents were granted to Mr. Leonard covering valuable improvements in gear boxes, transmission devices and other parts for motor cars.



Executives of Ward Leonard Electric Company.

The increase from the small beginning in 1892 to the present organization of the Ward Leonard Electric Company is undoubtedly largely due to two things: first, the ingenuity and inventive ability displayed by the founder of the company and its various engineers, and second, to the fact that the executive heads of the company have consistently endeavored to have all of the prominent employees interested in the company as stockholders as well as employees. As the result of the interest naturally aroused by such a plan of co-operation, the company has a most interestingly large number of men who have been in its employ for a long time.

The accompanying photograph of the six executive heads of the organization shows (beginning at the left) D. J. Burns, vice-president, H. Ward Leonard, consulting engineer, Leonard Kebler, president, A. E. Waller, production manager and manager of the rheostat department, George W. Camp, general superintendent, and Walter K. Mott, secretary and treasurer. Three of these have been connected with the organization since its founding over 22 years ago, two have been with it over 15 years, and one over six years. Three more of the department heads also started with the organization over 22 years ago.

During this entire period there has been a steady and consistent endeavor to manufacture primarily the highest quality of apparatus, and secondly apparatus that is comparatively inexpensive. As a result, the company's clientele includes a large number of concerns who have been customers of the company for over 20 years. The Ward Leonard Electric Company is almost the only electrical concern manufacturing small apparatus which has made steady progress for the past 22 years, and has still retained its identity in competition with the very large manufacturing corporations in the electrical field.

The Hydro-Electric Power Commission of Ontario is erecting a six-story office building in Toronto, Canada, to meet the need for additional office room for its enlarged staff.

Westinghouse Electric Railway Exhibit at the Panama-Pacific International Exposition.

One of the most striking exhibits to be made at the Panama-Pacific Exposition at San Francisco will undoubtedly be that of the Railway Department of the Westinghouse Electric & Manufacturing Company, which includes one of the Pennsylvania Railroad locomotives mounted on a turntable.

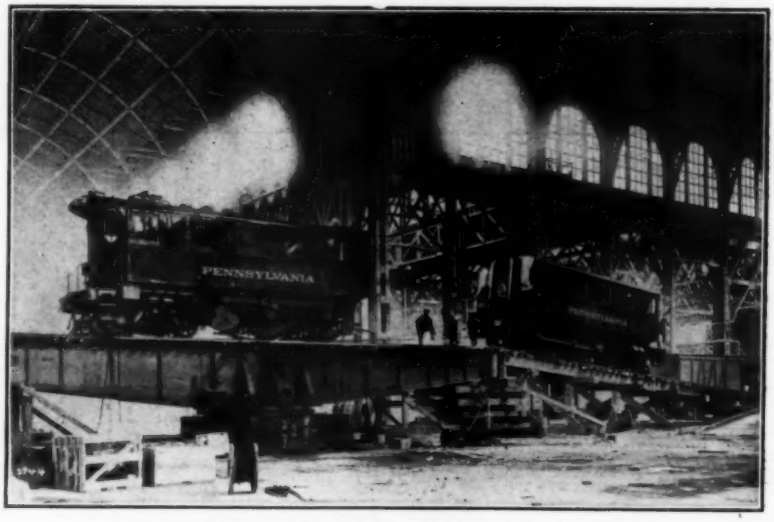
The location of the turntable is under the center of the dome of the immense Transportation Building at the junction of the two main aisles, thus bringing it in full view of the crowds of visitors that are expected to pass through this building, which will contain a large number of exhibits of great interest to the public at large.

The turntable is 65 feet long, and weighs 440,000 pounds, including the locomotive. The height of the track is 12 feet above the floor, and steel ties are used, a new type of construction for this class of work.

By means of a 10-horsepower, three-phase, 220-volt motor the turntable is caused to revolve at a speed of once in three minutes, thus giving the spectators in each end of the building different views of the locomotive. The rotation, which can be reversed in direction, is under the control of the operator located in a booth nearby.

A decidedly unique method of collecting the current for lighting the locomotive is employed. This was designed by the Westinghouse engineers and involves bringing the leads up through center bearing to collector rings, thus obviating the use of third-rail shoes or trolleys.

The locomotive is arranged and lighted so as to permit the people to pass through it and inspect the equipment.



Part of Westinghouse Railway Exhibit at San Francisco.

It is clamped to the turntable by means of steel bands, so as to prevent any possibility of its becoming dislodged in the event of an earthquake.

This locomotive is said to be the largest in the world in passenger service. It consists of two units and weighs 156 tons, and is the first side-rod gearless locomotive ever placed in service. It is equipped with two motors having a total capacity of 4,000 horsepower, and Westinghouse unit-switch-control equipment of the HBF type, which has made the phenomenal record of 99,549 miles per train-minute delay due to power-control failure. Twelve million passengers annually are transported over the electrified terminal of the Pennsylvania Railroad from Harrison, N. J., to Pennsylvania Station, New York City, by these locomotives, which are capable of attaining a speed of 60 miles per hour with a full train.

In addition to the locomotive, the newly developed types PK and HL control for railway motors will be shown in actual operation. These control equipments will operate motor racks equipped with 40-horsepower motors.

A complete line of commutating-pole railway motors, including box and split-frame types for various voltages from 600 to 1,500, will also be shown, and in addition a preliminary sample of the new pressed-steel railway motor.

On the tunnel section of the Harecastle Canal in England, which is about 1.65 miles long, electric haulage by means of storage-battery towing barges has been adopted. The towing barge can haul 17 loaded trailing barges, each carrying 45,000 pounds.

New Franks Desk and Table Lamps.

A new line of portable desk and table lamps, made entirely of metal and designed along simple but pleasing lines, has been placed on the market by the Franks Manufacturing Company, Rock Island, Ill.

Fig. 1 below shows one of these lamps of the adjustable type designed for use on roll-top desks or pianos. The heavily weighted base is 7.25 inches in diameter and contains a ball and socket joint permitting adjustment in every direction through a considerable angle. The arm remains set at the angle to which adjusted. A felt pad secured to the base prevents scratching even highly polished furniture. The shade is made of a single seamless piece of brass with aluminum finish inside. Being mounted in a trunnion-like yoke, the shade is also adjustable. A pull-chain socket, silk-covered cord and separable attachment plug complete the outfit, which is highly finished in brush brass or statuary bronze, making a very attractive and handy desk lamp. A similar lamp with non-adjustable base, similar to that shown in Fig. 2, is also made.

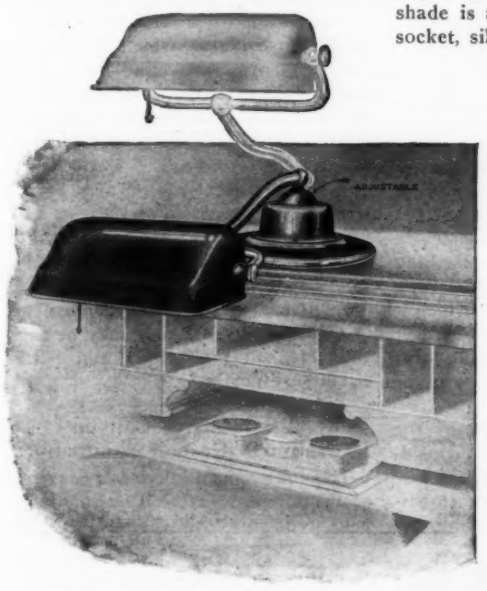


Fig. 1.—Franks Adjustable Roll-Top Desk and Piano Lamp.

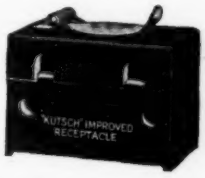
Fig. 2.—Flat-Top Desk and Table Lamp.

Fig. 2 shows an upright lamp with a height of 15 inches to the center of the shade, which is made like that shown in Fig. 1. The base has a felt pad to prevent scratching. A pull socket, nine-foot silk cord and two-part plug are furnished. This lamp is well adapted for use on flat-top desks, library tables, directors' tables, etc. A similar outfit with two lamps and shades is also made.

All of the lamps in this line are sturdily built for service and yet their neat outlines and finish add attractiveness to their use.

Kutsch Receptacle and Plug.

Where flexible connections are frequently to be made for a projecting lantern, motion-picture machine, large portable motor, storage battery or other current-consuming device taking considerable current, a receptacle and plug specially designed for heavy currents must be employed. For such service the receptacle and plug illustrated herewith are giving exceptionally good results. The receptacle is made of porcelain in two parts. The lower part or base can be connected directly to the circuit without requiring an iron box, except in theaters where boxes must always be used. The base contains the phosphor-bronze contact clips and the copper terminals to which the circuit wires are attached.



Heavy-Current Receptacle.

Plug for Same.

Receptacle with Plug Inserted.

On the top is a spring hinge cover which is lifted by hand before inserting the plug; on withdrawing the latter the cover closes automatically. All of the electrical contacts and connections are entirely inclosed. For theater outfits the porcelain in the bottom of the well can be readily knocked out to conform to requirements for an open bottom.

A forked hardwood handle is provided for the plug, and this holds a porcelain block to which the copper contact plates and terminals are attached. The latter must first be soldered to the

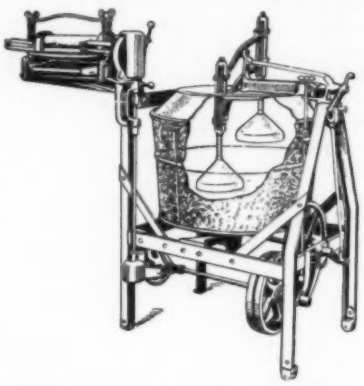
cable, then pushed through the handle and fastened to the contact plates. This facilitates soldering and also makes it easy to change the cable from one plug to another. The plug is not normally reversible to guard against wrong connections for storage batteries; by removing the round-headed screw from the lower end of the plug, however, the plug can be instantly made fully reversible.

These receptacles and plugs have found particularly extensive use on theater stages. In Chicago they are employed in all the larger theaters and at one time, directly after the disastrous Iroquois Theater fire, no theater not provided with them was allowed to reopen.

This line of receptacles and plugs is manufactured by L. W. Kutsch, 1837 North Fairfield Avenue, Chicago, Ill.

Beebe Electric Vacuum-Cup Washing Machine.

An electrically driven washer of simple and original design has been placed on the market by the Beebe Sales Company, Minneapolis, Minn. It operates on the vacuum-cup principle, which involves forcing a strong flow of the hot, soapy water through the body of clothes with the least possible wear and tear on the fabrics. This is done by means of two air-tight cups that are worked up and down alternately; on the downward strokes the cups force the water down through the clothes, while on the upward stroke the vacuum or suction action draws the water up through the clothes, this reversing action removing the dirt in the interstices of the densest or finest fabric much more thoroughly than by any washboard or other rubbing process and with an infinitesimal amount of wear. During the reciprocation of the cups the tub is slowly revolved so as to expose the entire contents to the washing process. But a small amount of electric power is used and in 10 to



View Showing Principle of Vacuum-Cup Washer.

15 minutes an entire batch of clothes is thoroughly washed and ready to be wrung out.

Wringing can be done independently of or at the same time as the washing is going on. The wringer can be swung into three positions, in each of which it can be driven forward or backward at the control of a lever. A separate lever controls the operation of the washing cups.

In the design of each part of the machine service was the first consideration. No attempt was made to disguise the fact that the outfit is primarily a laundry machine. All parts

Beebe Electric Laundry Machine, Open Position Showing Cups.

are therefore built of metal sturdily braced and riveted together. The framework is of steel, the tub is galvanized open-hearth steel or copper, as desired, and the vacuum cups are of aluminum. The motor and wringer are of high-grade type. Water can be with-drawn from the bottom of the tub without lifting or tilting the machine after the washing is completed. Castors permit easy moving of the machine about the room.

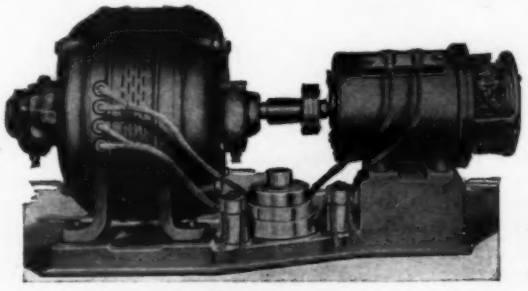
Wagner Battery-Charging Motor-Generator Set.

The increasing use of small storage batteries, especially for automobile lighting and ignition, makes it necessary for the garage to be equipped so as to charge these batteries economically. The motor-generator set, illustrated herewith, is manufactured by the Wagner Electric Manufacturing Company, St. Louis, Mo., especially for this use.

The generator of this charging set is identical with that supplied as a part of the Wagner electric self-starting system, now used on over 100,000 automobiles. The characteristics of the generator are such that the charging rate is automatically controlled, without the use of any external device. Generators are supplied for either 6-volt or 12-volt batteries. The 12-volt charger takes care of one 12-volt battery or two 6-volt batteries in series.

The motor is a standard Wagner single-phase motor, which the Wagner company originated and has manufactured since 1897. It is designed to operate on 60 cycles, which is the usual lighting-circuit frequency, and on either 110 or 220-volt circuits. A 110 or 220-volt direct-current motor may be supplied.

A simple snap switch controls both alternating and direct-current circuits. The leads for both alternating and direct-current circuits are conveniently brought out so that they may be easily connected to the supply and battery circuits, respectively.



Wagner Battery-Charging Set.

Annual Salesmen's Convention of National Carbon Company.

The ninth annual salesmen's convention of the National Carbon Company will be held at Factory "A," Cleveland, O., February 23 to 26, inclusive. Nearly 200 people representing the management, sales and engineering departments of the nine factories will be in attendance. An extensive program of papers has been prepared on the following general subjects: advertising and selling, illumination, carbon brushes, dry cells and storage batteries. Practical demonstrations will be held daily in which the new features and uses of the company's product will be thoroughly explained.

Latest Approved Fittings

The electrical fittings illustrated and described in this department have been approved by the Underwriters' Laboratories, Incorporated, following examination and tests conducted under standards of the National Electrical Code as recommended by the National Fire Protection Association.

CABINETS. — Metropolitan Engineering Company, 1230 Atlantic Avenue, Brooklyn, N. Y.

Type "E" equipment, consisting of a sheet-steel cabinet, catalog No. 949, inclosing a two-wire cartridge-fuse cutout base with meter-testing clips, catalog No. 159. Rating, 30 amperes, 250 volts.

When used at service entrances a fused service switch must also be used.

Approved January 11, 1915.

CONDUIT BOXES, Fittings for.—Pass & Seymour, Incorporated, Solvay, N. Y.

Supports of galvanized sheet steel for securing receptacles and rosettes in 3.25-inch outlet boxes not provided with threaded lugs for attaching covers or receptacles, catalog Nos. 1179, 1180.

Standard only for use where receptacle or rosette can be drawn tight against wall or ceiling or edges of outlet box.

Approved January 12, 1915.

CUTOUT BASES, Cartridge Fuse.—Metropolitan Engineering Company, 1250 Atlantic Avenue, Brooklyn, N. Y.

Type "E" equipment, consisting of a two-wire cartridge-fuse cutout base with meter-testing clips, catalog No. 159, inclosed in a sheet-steel cabinet, catalog No. 949. Rating, 30 amperes, 250 volts.

When used at service entrances a fused service switch must be used.

Approved January 11, 1915.

FIXTURES.—Cohen & Company, 9 East Broad Street, Richmond, Va.

Fixtures shown by examinations conducted by Underwriters' Laboratories to be in accordance with requirements of National Board of Fire Underwriters have labels attached.

Approved January 9, 1915.

FIXTURE PARTS.—National X-Ray Reflector Company, 235 West Jackson Boulevard, Chicago, Ill.

"Nat'l X-Ray Ref. Co." reflector holders used in fixture construction.

75 watts, 125 volts, show-window and show-case reflectors for candelabra lamps, catalog Nos. S-109-S-115 inclusive, with No. 18 B. & S. gauge brass tubing used in assembling parts.

Approved December 22, 1914.

FUSES, Cartridge Inclosed.—Killark Electric Manufacturing Company, 2005 Locust Street, St. Louis, Mo.

"Killark," inclosed cartridge fuse, 250 volts, 0-200 amperes.

Approved January 12, 1915.

HEATERS, Electric.—E. E. Stevens, submittor, 939 McGarry Street, Los Angeles, Cal. Manufactured for above by John Maddock & Sons, Trenton, N. J.

Electrically heated toilet seat, 0.1 ampere, 110 volts, consisting of a porcelain seat with hollow interior containing a resistance winding. Connection to supply circuit is made by approved portable cord and an approved attachment plug.

The temperature produced by this device as an electric heater is not such as to be considered dangerous from viewpoint of fire hazard.

Deterioration due to effects of moisture, corrosion or breakage of parts may, however, under necessary conditions of use, result in a hazard to persons which must be recognized and which is not judged to be adequately guarded against in this device.

Approved January 11, 1915.

INSULATING MATERIALS.—The Woodbridge Pottery Company, Woodbridge, N. J.

Colored vitrified porcelain, having non-absorptive, non-combustible and insulating qualities, rendering it suitable for use in low-voltage electrical appliances, where ordinary white porcelain has been accepted as standard.

Approved January 12, 1915.

LIGHTNING RODS. — St. Louis Lightning Rod Company, St. Louis, Mo.

"Kretzer" copper cable weighing not less than three ounces per foot and with strands not less than No. 17 B. & S. gauge.

Copper tubing not less than five-eighths inch in diameter and one-thirty-second inch thick.

Star-section, twisted, hot-galvanized steel rod weighing approximately 5.25 ounces per foot.

Star-section, twisted steel rod, copper-plated and sheathed in No. 32 B. & S. gauge copper, and weighing 7 ounces per foot.

Approved December 24, 1914.

RECEPTACLES, Standard. — Benjamin Electric Manufacturing Company, 120 South Sangamon Street, Chicago, Ill.

"Benjamin" keyless, porcelain shell, 660 watts, 250 volts. Cleat, catalog Nos. 9401, 9402.

Approved December 21, 1914.

RECEPTACLES, Standard.—Thomas Cusack Company, submittor, Harrison and Loomis Streets, Chicago, Ill. Manufactured by The Bryant Electric Company, Bridgeport, Conn.

Sign receptacle, 660 watts, 250 volts, catalog No. T. C. 22.

Approved December 3, 1914.

RHEOSTATS.—Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

126 to 650 volts, all capacities.

Starting and regulating; types DAC, DAS, DS, DC, HC, HS, IC, IS.

Approved January 12, 1915.

SOCKETS, Standard. — Benjamin Electric Manufacturing Company, 120 South Sangamon Street, Chicago, Ill.

"Benjamin" porcelain shell. Keyless, 1,500 watts, 250 volts, catalog Nos. 69, 169, 691, 692.

Approved January 5, 1915.

SOCKETS, Weatherproof.—John I. Paulding, New Bedford, Mass.

3 amperes, 250 volts. Catalog Nos. 9366, 43310, 60666.

Approved November 27, 1914.

SWITCHES, Combination Cutout.—The Bryant Electric Company, Bridgeport, Conn. "Bryant" or "Perkins." Double-pole, snap switches combined with Edison plug cutouts, 10 amperes, 125 volts, catalog No. 2598.

Approved January 4, 1915.

SWITCHES, Combination Cutout.—D. & W. Fuse Company, Providence, R. I.

Panel cutouts with knife switches and plug fuses. Catalog Nos. 25028-25031 inclusive, 0-30 amperes, 125 volts.

Approved December 16, 1914.

SWITCHES, Push-Button Flush.—The Bryant Electric Company, Bridgeport, Conn. "Bryant" or "Perkins."

Single-pole, 5 amperes, 250 volts, 10 amperes, 125 volts, catalog No. 601.

Double-pole, 10 amperes, 250 volts, catalog No. 602.

Double-pole, 20 amperes, 250 volts, catalog Nos. 609 and 2623.

Three-way, 5 amperes, 250 volts, 10 amperes, 125 volts, catalog Nos. 603, 2524, 2527.

Also above types with lock attachment.

Approved January 5, 1915.

SWITCHES, Surface Snap.—The Bryant Electric Company, Bridgeport, Conn. "Bryant" or "Perkins."

With metal covers.

Three-pole, 10 amperes, 250 volts, catalog Nos. 2633 and 2634.

Approved January 13, 1915.

WIRES, Miscellaneous.—Chicago Insulated Wire and Manufacturing Company, Sycamore, Ill.

Flexible cable having slow-burning insulation, for use with picture machines.

Marker, two brown threads woven parallel in inner braid.

Approved January 4, 1915.

Current Electrical News

NORTH CENTRAL STATES.

CANTON, O.—The city is considering the establishment of an electrical department, to be operated under the direction of the safety department. The proposed bureau will have charge of all contract and construction work involving wiring or the use of electricity, and will be directed by the city electrician.

EAST PALESTINE, O.—The board of public affairs has been authorized to purchase new equipment for the electric lighting plant and a bond issue for that purpose has been authorized. The new machinery will double the capacity of the lighting plant.

PARIS, ILL.—A plan to install six cluster lights on each side of the square is being discussed by citizens of Paris. Roscoe A. Coffman is one of the men interested in the movement.

SPRINGFIELD, ILL.—The Hoyleton Electric Light Company has been incorporated with a capital stock of $5,000. The company is to construct a plant and furnish electric light, heat and power. The incorporators are K. A. Steinhauser, C. A. Steinhauser and H. W. Rixmann.

ALCESTER, S. D.—The commercial club of Alcester has appointed a committee to investigate the possibilities of establishing a municipal electric lighting plant in that town. Address town clerk.

FAIRPLAY, MO.—The citizens have voted to extend the electric lights to all parts of the town. The town has been in darkness for the last two months, the new plant not having been completed. It has been purchased from Akins Brothers by J. W. Lowery, of Dunnegan, who will push its completion.

LATHROP, MO.—The holdings of H. C. Shepherd, S. L. Stucky, and E. D. Rogers in the Lathrop Light, Heat and Power Company, have been sold to G. Grant and E. S. Grant. Control of the company is transferred to the new stockholders. M.

SOUTH CENTRAL STATES.

FALMOUTH, KY.—Sealed bids are being received by Mayor N. C. Ridgway for the $3,000 of bonds voted by the city to pay for improvements to the electric lighting system and the water works. W. E. Wilson is city clerk.

LEXINGTON, KY.—F. J. Manley, of the business men's committee, which is working on the "white way" proposition, and F. W. Bacon, vice-president of the Lexington Utilities Company, reported at a recent meeting of the Board of Commerce that the new lighting system for down-town streets might be ready for inauguration on April 1. A special celebration will be arranged for the occasion.

LOUISVILLE, KY.—Electrical contractors of Louisville have been delayed on new work by the weather, which has stopped building operations for the time being. There is much ahead when the weather opens up and progress will be rapid after that. Indications point to a busy spring.

MANCHESTER, TENN.—The Tennessee Power Company has taken charge of the local plant of the Duck River Power Company, furnishing electric lights to Manchester, the deal by which the property changed hands including also the plant at Shelbyville, which supplies this city and Wartrace. The local plant is inadequate for local needs and it is understood that a transmission line will be constructed from the main cable at McMinnville to this place.

BRISTOW, OKLA.—Though the city of Bristow, Okla., issued bonds for a municipal electric light plant two years ago, the securities never have been sold, and sentiment in the city now is strongly in favor of a privately owned plant. A recently organized commercial club is considering propositions, and it is probable that before the next six months have passed, the city will grant a franchise. B.

YALE, OKLA., has voted $22,000 in municipal bonds for the extension of the city water works and the installation of a municipal electric light plant. The vote was unanimous for extension of water mains and only five voted against the municipal light system.

MARSHALL, TEX.—The Marshall Electric, Ice and Traction Company will make improvements to its ice factory and electric light plant to cost about $75,000. D.

OZONA, TEX.—Frank F. Friend and associates are constructing an electric light and water works plant here.

YORKTOWN, TEX.—The Texas Southern Electric Company is negotiating for the purchase of the local electric light plant. If the transaction is consummated the plant will be improved. D.

WESTERN STATES.

CHEYENNE, WYO.—The Western Power Company, it is announced, is preparing to spend $50,000 on improvements to its power plant here, with the intention of making it a central distributing station for southern Wyoming.

PHOENIX, ARIZ.—The Falls Power and Electric Company is promoting a proposition for supplying the farms northeast of this city with electricity. The directors of the company are: John Munson, H. Lepplac, W. B. Twitchell, W. S. Perry, A. G. Bailey, C. M Etter and T. T. Powers. It is understood about $45,000 has been subscribed by the farmers.

CORDOVA, ALASKA.—Harry H. Knox, president and manager of the Alaska Electric Consolidated Company, which was recently granted by the Council a franchise to install, operate and maintain an electric light and power plant in this city, now announces that funds sufficient to cover cost of installation have been arranged for, and that work on the proposed plant will begin as soon as weather conditions permit. O.

COLFAX, WASH.—Charles H. Hinchcliff, of the Elberton Building and Power Company, of Elberton, Wash., near this city, recently petitioned the City Council for a 50-year power and light franchise, stating that he proposes building a 1,500 horsepower plant near Elberton, and that if the franchise is granted, he will supply Elberton, Colfax, and contiguous territory with current for light and power. The company can develop 1,500 horsepower for nine months in the year, and 200 horsepower for the remaining three months. A small auxiliary will be built and operated during the period of low water. The City Council and Mayor Rogers are considering the proposition, and it is reported it is favored by them. O.

MONTESANO, WASH.—According to plans just made public by R. J. Andrus, manager of the Northwest Electric and Water Works, of this city, in addition to the new plant, the feeders in all parts of the city will be rebuilt and heavier copper strung to take care of the increasing demands.

SPOKANE, WASH.—J. B. Ingersoll, consulting engineer, employed by the city of Spokane to investigate the feasibility of several waterpower sites whereon the city contemplates establishing a municipal light and power plant, has made his final report to the City Council, and according to authentic information the proposition of establishing a plant on one of the several sites investigated will be placed before the Council for consideration in the near future. Mayor C. M. Fassett is chairman of the committee which was appointed by the Council to make investigations. O.

WALLA WALLA, WASH.—The City Commissioners have been petitioned by 50 business firms of the city to install a cluster street-lighting system on Fourth Street, from Main to Rose, Rose from Fourth to Second Street, and North Second Street from Main to N. P. Depot. It is announced the Council will order the improvement in the near future. O.

LEXINGTON, ORE.—J. B. Sparks, of Heppner, is preparing to construct an electric light plant at Lexington.

PORTLAND, ORE.—Bids are being taken for furnishing the city with 14,650 feet of cable and three transformers, according to plans on file with Purchasing Agent J. R. Wood.

PORTLAND, ORE.—NePage, McKenny & Company, of this city, are to

install a light distributing system at Ridgefield, Wash., for connection with about 200 houses. J. H. Sroufe, manager of the local office, will have charge of the work.

TILLAMOOK, ORE.—J. R. Wheeler, electrical engineer, of this city, has practically completed plans for the installation of an up-to-date lighting system at Bar View, near this city, and it is reported work will be started on the improvement just as soon as materials can be placed on the ground. The work will be completed before the summer season. For information regarding the furnishing of materials and installation of same, address Mr. Wheeler, this city. O.

FRESNO, CAL.—The city trustees have awarded the contract for installing the new electrolier system here to the Woodhill-Hulse Electric Company of Los Angeles, for $36,973. Cast-iron posts will be used. There were seven bidders, the highest bid being $49,950 for concrete posts. The system is to be completed not later than June 15.

PASADENA, CAL.—The City Commission has ordered the improvement of Terrace Drive, between Colorado Street and Elevado Drive, and certain other streets, with underground conduits for carrying light, power and other wires in accordance with plans on file with the city engineer.

SAN MATEO, CAL.—The City Council has passed a resolution of intention for the construction of an ornamental street-lighting system.

PROPOSALS.

MAGNETOS.—Sealed proposals will be received at the office of the Chief of Ordnance, United States Army, Washington, D. C., until February 23, for furnishing and delivering, f. o. b. contractor's plant, type GA firing magnetos.

UNDERGROUND WIRES.—Sealed proposals will be received until March 1 for the laying of underground wires and the installation of lamp posts in the extension of ornamental street lighting system, including the labor and material. All bids must be in accordance with the plans and specifications prepared by J. J. Smith, city engineer, of Grand Forks. Address W. H. Alexander, city auditor.

PANAMA CANAL SUPPLIES.—Sealed proposals will be received at the office of the General Purchasing Office of the Panama Canal, Washington, D. C., until February 18, for furnishing, by steamer, free of all charges, on dock at either Colon (Atlantic port) or port of Ancon (Pacific port), Isthmus of Panama, the following: electric motors, cable bells, electric valves, in accordance with circular No. 900, obtainable from the office named.

FOREIGN TRADE OPPORTUNITIES.

[Addresses may be obtained by writing (mentioning file numbers) to the Bureau of Foreign and Domestic Commerce, Washington, D. C., or to the nearest of its branches at Boston, New York, Atlanta, Chicago, New Orleans, Seattle and San Francisco.]

NO. 15,482. POCKET ELECTRIC LAMPS, ETC.—A dealer in sporting goods, etc., in France has informed an American consular officer that he wishes to receive catalogs and price lists on sewing machines and pocket electric lamps. Correspondence should be in French and prices stated in francs; weights and dimensions should be in the metric system.

NO. 15,485. STEAM TURBINES AND ENGINES.—A merchant in Russia informs an American consul that he wishes to be placed in communication with manufacturers of steam turbines and steam engines. It is desired to purchase such engines, etc., as will permit the use of back pressure steam for drying and boiling purposes. Correspondence may be in English. Bank reference is offered.

NEW PUBLICATIONS.

YEAR BOOK FOR 1915.—The Bureau des Longitudes has published the "Annuaire Pour L'An 1915," containing astronomical, meteorological, statistical, geographical, and other tables for the current year, as well as a complete calendar. The appendix contains an article by G. Bigourdan on "Methods for Testing Mirrors and Objectives." It is published by Gauthier-Villars & Company, Paris, France, for 1.85 francs.

RESISTANCE OF IRON.—The Bureau of Standards, Washington, D. C., has published Scientific Paper No. 236, entitled "Electrical Resistance and Critical Ranges of Pure Iron," by G. K. Burgess and I. N. Kelberg. Curves and tables are given showing the variation of resistance with temperature.

LENGTH OF ELECTROMAGNETIC WAVES.—Scientific Paper No. 235 of the Bureau of Standards, Washington, D. C., is entitled "A Direct-Reading Instrument for Measuring the Logarithmic Decrement and Wave-Length of Electromagnetic Waves," by Frederick L. Kolster. This describes a new form of decremeter and explains the theory.

SILVER VOLTAMETER.—Scientific Paper No. 240, published by the Bureau of Standards, Washington, D. C., is entitled "Studies on the Silver Voltameter," by G. A. Hulett and G. W. Vinal. This describes comparisons of different forms of voltameters, and explains why different results have been obtained by different forms.

ENGINEERING AT HOPKINS.—"A Department of Engineering in the Johns Hopkins University" is the title of a reprint by John B. Whitehead, professor of electrical engineering. The paper was presented to the Society for Promotion of Engineering Education. It points out the prominence given to fundamentals in the undergraduate course at this university.

SMITHSONIAN INSTITUTION.—The annual report of the Smithsonian Institution for 1913 has been published. Among the papers included in the appendix to this report are the following: "Recent Developments in Electromagnetism," by Eugene Block; "Wireless Transmission of Energy, by Elihu Thomson.

TUNGSTEN LAMPS.—Scientific Paper No. 238 of the Bureau of Standards, Washington, D. C., is entitled "Characteristic Equations of Tungsten-Filament Lamps and Their Applicaton in Heterochromatic Photometry." This is a revision of the paper presented at the convention of the Illuminating Engineering Society in September, 1914.

ELECTROTECHNICAL ASSOCIATION OF ARGENTINA.—Asociacion Argentina de Electro Tecnicos has begun the publication of a *Boletin* containing technical papers on electrical subjects. The new publication began in October, 1914, and is appearing monthly. It is printed in Spanish.

NEW INCORPORATIONS.

PITTSBURGH, PA.—Wile Electric Finance Company; capital $100,000.

FINDLAY, O.—The Modern Light and Power Company has been incorporated with a capital of $10,000 by R. C. Bishop and others.

FINDLAY, O.—Modern Light and Power Company; capital $10,000. Incorporators: R. C. Bishop, P. D. Elsea and L. B. Bishop.

NEWARK, O.—The Butler Fan and Motor Company has been organized with a capitalization of $10,000, to engage in the supply trade.

KANSAS CITY, MO.—The Frank Knapp & Son Electric Company has been incorporated with a capital of $10,000 by Frank Knapp and others.

LIMA, O.—The V. H. Effinger Electric Company will manufacture electric and gas fixtures. It is capitalized at $10,000, and was organized recently by V. H. Effinger.

MILWAUKEE, WIS.—The Boggis-Dietz Electric Company has been incorporated with a capital of $10,000. Incorporators: H. F. Boggis, E. L. Dietz and E. Boggis.

NEW YORK, N. Y.—The Six-in-One-Fuse Company, Incorporated; electrical goods, etc. Capital $100,000. Incorporators: C. C. Balassa, J. P. Payor and J. Carl Becher.

NEW YORK, N. Y.—Witelite Electric Company, Incorporated. Electrical lighting and other apparatus. Capital, $10,000; incorporators, Bernard I. Kamen, Sol S. Ostertag and Max B. Rabinowitz.

CANTON, O.—The Wilson & Painter Electric Company, recently incorporated at Canton, O., with a capital stock of $15,000, will handle electrical supplies. J. B. Wilson, J. F. Painter and others are interested.

NEW YORK, N. Y.—Car Lighting Company, Incorporated. Electrical lighting apparatus for railroad cars, etc. Capital, $100,000. Incorporators: Lloyd O. Wilson, William H. Black and William P. Horn.

ATHENS, O.—The Southern Ohio Electric Central Station Company has been incorporated with a capital of $10,000. The incorporators are O. E. Harrison, H. C. Allread, F. N. Sinks, D. H. Sowers and Frank Tossey.

NORFOLK, VA.—Meeks-Reed Electric Company, Incorporated; to do an electric supply business. Capital $5,000 to $15,000. Incorporators: Ernest H. Meeks, president, Norfolk, Va.; W. H. Reed, secretary and treasurer.

CHICAGO, ILL.—The Elite Vacuum Cleaner Manufacturing Company has been incorporated with a capital of $15,000 to manufacture electrical goods, novelties and machinery. The incorporators are George W. Nilligan, Margaret Studer and Guy H. Powell.

NEW YORK, N. Y.—Newton Manufacturing Company, Incorporated; to make electrical appliances. Capital $25,000. Incorporators: Bruce M. Falconer, New York City; Philip Sinnott, Rosebank, N. Y.; Walter R. H. Hardingham, Plainfield, N. J.

BROOKLYN, N. Y. — Campbell Lamp and Light Specialty Company, Incorporated; gas and electric fixtures, devices, etc. Capital $15,00. Incorporators: Charles A. Campbell, Henry W. Van Allen, Brooklyn, N. Y., and E. C. Abell, New York City.

FINANCIAL NOTES.

At the annual meeting of the Southern New England Telephone Company, stockholders voted to authorize the directors to apply to the legislature for permission to issue $10,000,000 additional stock as needed from time to time. The present capitalization is $10,000,000, which is exhausted. Charles G. Dubois, comptroller of the American Telephone & Telegraph Company, was elected a director to fill the vacancy caused by the death of General Thomas Sherwin, of Boston. Other directors and retiring officers were reelected.

The Puget Sound Traction, Light & Power Company has sold to Harris, Forbes & Company, New York, an issue of $557,000 six-per-cent mortgage bonds, dated February 1, 1914, being part of an authorized amount of $15,000,000, of which $8,057,000 are outstanding. Earnings of the company for the year 1914 amounted to $8,450,973 in gross, net income after expenses and taxes was $3,443,965, and the balance after interest charges and bond sinking funds totalled $1,325,109. The bonds have been practically all sold.

The reorganization plan for Atlantic Gas & Electric Company now in the hands of receivers, by which the controlled properties of that corporation will be taken over by the General Gas and Electric Company has been approved by the various committees representing bondholders and stockholders of Atlantic Gas & Electric. After the taking over of the properties by General Gas and Electric Company, Atlantic Gas & Electric Company will go out of existence. Holders of Atlantic Gas & Electric "A" bonds will receive a 10-year five-per-cent gold bond of General Gas and Electric Company secured by the same collateral or its equivalent now securing the "A" bonds. Atlantic Gas & Electric "B" bonds will be paid off and to provide for immediate construction requirements a six-per-cent five-year secured note issue by General Gas & Electric Company has been created. Proceeds of this note issue will retire $650,000 of the old General Gas and Electric six-per-cent notes and also will provide part of the requirements for new construction in 1915. Additional funds will be provided from subscriptions by unsecured creditors and preferred stockholders of Atlantic Gas & Electric by subscriptions to securities of General Gas and Electric Company as previously announced. Atlantic Gas & Electric common stock may also participate in the reorganization and receive 50 per cent of common stock of General Gas & Electric for their subscriptions. As the reorganization committees have formally accepted the reorganization plan the properties of Atlantic Gas & Electric will be taken over by General Gas and Electric as soon as various details may be disposed of. Atlantic Gas & Electric controls electric lighting properties in Easton, Stroudsburg, Bangor and Bath, Pa., Philipsburg, Boonton, Dover and Rockaway, N. J., and Binghamton, N. Y. Gas properties also are operated in Easton, Philipsburg and Nazareth. General Gas and Electric controls the Sandusky Gas & Electric Company, the Northwestern Ohio Railway & Power Company and the Port Clinton Electric Light & Power Company in Ohio, and the Rutland Railway & Light Company, the Western Vermont Power & Light Company and the Pittsford Power Company in Vermont. The company was incorporated in July, 1912, and is under the management of W. S. Barstow & Company, Incorporated.

The United Light & Railways Company has sold to N. W. Halsey & Company, New York City, $1,500,000 six-per-cent secured notes dated January 1, 1915, and maturing $750,000 on January 1, 1918, and $750,000 on January 1, 1920. Proceeds of the sale will be used to complete payment on properties acquired and reimburse the treasury for improvements. Notes are being offered for subscription on a basis to yield 6.75 per cent.

Ontario Power Company has called a meeting of stockholders for February 16, at Niagara Falls, to authorize the issue of $1,660,000 five-year six-per-cent second-mortgage convertible bonds. These bonds will be secured by a mortgage on the assets and undertakings of the company and also will secure two issues of debentures now outstanding to an amount of $3,340,000. An increase in the capital stock of the company from $10,000,000 to $15,000,000 also will be considered.

The Consumers Power Company of Minnesota has sold to William P. Bonbright & Company, Incorporated, New York City, an additional amount of its collateral trust six-per-cent four-year notes dated November 1, 1913. The notes are part of an authorized issue of $3,000,000, of which $934,500 is outstanding, and are being offered for subscription at 97.75 and interest to net seven per cent. A large part of the offering has been sold.

Dividends.

	Term	Rate	Payable
Cent. Ark. Ry. & Lt. Corp	Q.	1.75%	Mch. 1
Detroit United Rys.	Q.	1.5 %	Mch. 1
Kings Co. E. L. & P.	Q.	2 %	.....

Reports of Earnings.

KEYSTONE TELEPHONE.

The annual report of the Keystone Telephone Company of Philadelphia for the year ended December 31, 1914, compares as follows:

	1914.	1913.
Gross	$1,321,226	$1,265,778
Net profits for year	*357,516	319.077
Surplus after dividends, etc.	77,294	96,311

* Equal to 18.4 per cent earned on $1,936,850 six-percent cumulative preferred stock compared with 16.5 per cent earned in 1913.

DETROIT EDISON COMPANY.

	1914.	1913.
December gross	$ 714,422	$ 583,173
Net	359,619	275,096
Surplus after charges	277,871	211,665
Balance after depreciation reserve	240,717	178,391
Twelve months' gross	6,495,814	5,546,587
Net	2,821,063	2,324,360
Surplus after charges	1,938,751	1,628,658
Balance after depreciation reserve	1,418,751	1,118,658

DAYTON POWER & LIGHT.

	1914.	1913.
December gross	$ 97,106	$ 84,963
Net	45,574	38,230
Surplus after charges	27,649	20,928
Twelve months' gross	945,563	734,769
Net	427,012	309,149
Surplus after charges	219,364	111,394
Balance after preferred dividends	103,145	10,159

AMERICAN LIGHT & TRACTION.

The American Light & Traction reports for the year ended December 31 follow:

	1914	1913
Earnings on stock owned	$ 3,714,959	$ 3,751,976
Miscellaneous earnings	717,420	714,257
Gross earnings	4,432,380	4,466,233
Expenses	157,292	123,107
Net earnings	2,275,087	4,343,126
Surplus Dec. 31, 1913	9,495,882	8,689,292
Total sur., Dec. 31, 1914	13,770,969	13,032,419
Dividends on pfd.	854,172	854,172
Cash divs. on com.	1,478,880	1,341,182
Stock divs. on com.	1,478,880	1,341,182
Total divs., 1914	3,811,932	3,536,537
Surplus Jan. 1, 1915	9,959,037	9,495,882

PERSONAL MENTION.

MR. FREDERICK UNGER, manager of the Chicopee, Mass., municipal electric light plant, has resigned that position.

MR. ELMER STUCKY, after 14 years' service with the Leavenworth Electric Light Company, has resigned as superintendent. He will be succeeded by H. D. Johnson, an electrical engineer of New York.

MR. J. H. SEAVER, formerly superintendent of the Great Shoshone & Twin Falls Water Power Company, at Twin Falls, Idaho, has resigned his position to take up farming in Castleford County. Mr. Seaver was identified with the power company for seven years.

MR. A. H. S. CANTLIN, vice-president and general manager of the Lehigh Valley Light and Power Company of Allentown, Pa., will present a series of lectures before the students in economics of the Allentown College for women on the subject of "How a Big Business is Managed from the Practical Side."

OBITUARY.

MR. JOHN P. JUDGE, manager of the Baltimore office of the General Electric Company, died very suddenly Wednesday evening, January 27, while presiding at a church meeting. For many years Mr. Judge was a faithful employee of the General Electric Company. He became affiliated with the old Edison Company in 1890, and four years later began his services with the General Electric Company. For many years he was connected with the power and mining department, and in 1912 was made manager of the Baltimore office. In the death of Mr. Judge the General Electric Company loses a most faithful employee and his loss will be mourned by many friends in Baltimore and vicinity. Besides his wife, Mr. Judge is survived by two sons, Joseph C. Judge, a lawyer, and John P. Judge, and four daughters, Mrs. John W. Mehling and Misses Marie, Gertrude and Catherine Judge.

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	Feb. 8	Feb. 1
American Tel. & Tel. (New York)	119⅞	120½
Commonwealth Edison (Chicago)	136	136⅝
Edison Electric Illuminating (Boston)	256	257
Electric Storage Battery common (Philadelphia)	48	47½
Electric Storage Battery preferred (Philadelphia)	48	47½
General Electric (New York)	141½	143
Kings County Electric (New York)	120	120
Massachusetts Electric common (Boston)	7	7¾
Massachusetts Electric preferred (Boston)	—	48
National Carbon common (Chicago)	130	—
National Carbon preferred (Chicago)	119¾	121
New England Telephone (Boston)	136	137
Philadelphia Electric (Philadelphia)	23⅜	23⅝
Postal Telegraph and Cables common (New York)	70	70
Postal Telegraph and Cables preferred (New York)	67	67½
Western Union (New York)	63¾	63¼
Westinghouse common (New York)	70	71
Westinghouse preferred (New York)	117	117

DATES AHEAD.

American Institute of Electrical Engineers. Midwinter convention, New York City, February 17-19. Secretary, F. L. Hutchinson, 33 West Thirty-ninth Street, New York, N. Y.

American Physical Society. Columbia University, New York City, February 27. Secretary, A. D. Cole, Columbus, O.

"Made in the U. S. A." Industrial Exposition. Grand Central Palace, New York City, March 6-13. President, H. A. Cochrane, Fifth Avenue Building.

New England Section, National Electric Light Association. Question Box convention, City Club, Boston, Mass., March 9-10. Secretary. Miss O. A. Bursiel, Boston, Mass.

Electrical Supply Jobbers' Association. Spring meeting, Hotel La Salle, Chicago, Ill., March 17-19. Secretary, Franklin Overbagh, 411 South Clinton Street, Chicago, Ill.

Minnesota Electric Association. Annual meeting, St. Paul, Minn., March 23-25. Secretary, F. A. Otto, St. Paul Gas Light Company, St. Paul, Minn.

National Association of Electrical Inspectors. Annual convention, Hotel Martinique, New York City, March 23-25. Secretary, W. L. Smith, Concord, Mass.

Electrical Committee, National Fire Protection Association. Meeting, New York City, March 24-25. Secretary. Ralph Sweetland, 141 Milk Street, Boston, Mass.

National Electric Light Association. Annual convention, San Francisco, Cal., June 7-11. Secretary, T. C. Martin, 29 West Thirty-ninth Street, New York.

With the Electrical Manufacturers

The Leeds & Northrup Company, 4901 Stenton Avenue, Philadelphia, Pa., has issued bulletin No. 765, which describes a student's form of potentiometer. It is of relatively simple construction, but high accuracy for voltage and current measurements.

The R. Thomas & Sons Company, East Liverpool, O., manufacturer of high-voltage insulators and special porcelains, has appointed Robert H. Anthony, of Boston, Mass., to add to its New York representation. Mr. Anthony previously traveled throughout the New England states.

The Electric Controller & Manufacturing Company, Cleveland, O., announces the appointment of the O. H. Davidson Equipment Company, Ideal Building, Denver, Colo., as its representative in Colorado, Utah, Montana, Wyoming, South Dakota, New Mexico and Arizona.

The Wallace Novelty Company, Incorporated, 22 East Forty-first Street New York City, is offering attractive prices to dealers of the Wallace portable electric lamp. This lamp was described in our issue of August 22, 1914, and since that time two other forms, known as Models B and C, have been added. The former has nickel finish and the latter satin brush brass finish, with push-button socket.

John H. Fowler Company, Fisher Building, Chicago, Ill., cedar-pole producer, is sending out an attractive calendar for February containing a reproduction of the famous painting, "The Last Stand." On the reverse side is a photograph of one of the winter logging camps of the company and a convincing discussion of the advantages of buying cedar poles direct from the producer, thus saving middleman's profit.

Diehl Manufacturing Company, Elizabeth, N. J., has issued an illustrated folder entitled, "Diehl to Dealer Sales Helps." Its object is to illustrate and describe the various aids which the company is offering to agents that handle its fans. Incorporated in this booklet are illustrations and descriptions of decalcomania window signs, newspaper electros, fan electros, lantern slides, booklets and window cards which are all furnished free to dealers to aid them to sell Diehl fans.

Western Electric Company, New York, N. Y., has added to its well known line of electrical household utilities the Geyser dishwasher made by the Electric Dishwasher Company, of Buffalo, N. Y. This machine was described in our issue of August 22, 1914. The machine is furnished in two types, one made in non-rusting Stannic metal, the other in heavy copper nickel-plated. To stimulate the sale of these machines, the Western Electric Company has ready for distribution among local dealers an attractive booklet entitled "Dishes and Drudgery" and a return-post-card folder entitled "Dishwashing."

The Engineering Department of the National Lamp Works of General Electric Company, Cleveland, O., has issued Bulletin 15A, entitled "Engineering Features of Electric Sign Lighting." This takes up in detail the elements of design which affect the legibility of electric signs, and gives instruction for good designing. Many curves are given for the relation between the various dimensions of signs to get good results. The wiring of signs, also, receives considerable attention, especially with regard to the grouping of lamps in series and in multiple. Figures are given for operating cost and an appendix contains data on Mazda sign lamps.

Record of Electrical Patents.

Issued by the United States Patent Office, February 2, 1915.

1,126,681. Signaling and Indicating Device. J. J. Aylward, Brooklyn, N. Y. Pointer of indicator is rotated by impacts on its shaft from several solenoids.

1,126,701. Semi-Mechanical Telephone System. A. M. Bullard, assignor to Western Electric Co. Semi-automatic system with district and office selectors.

1,126,727. Selector Switch. H. G. Dietl, assignor to Western Electric Co. Cylindrical contacts and special brushes for automatic telephone switch.

1,126,733. Cable Terminal. H. W. Dunbar, assignor to Western Electric Co. Cable box with fuses and lightning arresters on three of the four accessible sides of the sealed rectangular cable head.

1,126,745. Telegraphic Type-Printing Receiver. A. Franke, and E. Ehrhardt, assignors to Siemens & Halske A. G., Berlin, Germany. Comprises a receiver, a distributor, a registering band, electromagnetic punches perforating the band, a selector, a printing mechanism and control relays.

1,126,751. Recording Device for Telephone Pay-Stations. M. M. Goldberg, Dayton, O., assignor of one-half to V. F. King. Coin-controlled signal and counter.

1,126,762. Lifting-Magnet Controller. C. T. Henderson, assignor to Cutler-Hammer Mfg. Co., Milwaukee, Wis. Cam-controlled switches for connecting and reversing line connections and short-circuiting the magnet.

1,126,775. Closed-Circuit Signal System. E. M. Jones, assignor to Jones Signal System, Atlanta, Ga. Both track and locomotive circuits are normally closed.

1,126,776 and 1,126,777. Electric Signal System. E. M. Jones, assignor to Jones Signal System Co., Atlanta, Ga. Interaction of track and locomotive circuits.

1,126,778. Automatic Signaling and Train-Stopping Device. E. M. Jones, Atlanta, Ga. Motor drives signal through chain.

1,126,786. Focusing Socket. G. C. Knauff, Chicago, Ill. Socket is axially adjustable in automobile headlight reflector.

1,126,788. Electric Switch. L. F. Kries, Baltimore, Md. Inclosed fused service switch.

1,126,800. Arc Lamp. G. M. Little, assignor to Westinghouse Electric & Mfg. Co. Provides special electrode ventilation.

1,126,803. Telephone-Exchange System. F. R. McBerty, assignor to Western Electric Co. Includes automatic selector switches with special sender apparatus.

1,126,804. Power System for Automatic Switches. F. R. McBerty, assignor to Western Electric Co. Alternate switches of each group are driven from different sources.

1,126,826. System of Electrical Signaling. E. G. Missbach, assignor to Siemens & Halske Aktiengesellschaft, Berlin, Germany. A large transmitter operates a number of small receivers.

1,126,834. Electric Switch-Lock. W. P. Neubert and W. E. Smith, assignors to Union Switch & Signal Co., Swissvale, Pa. Electromagnetically actuated lock for switch-operating lever.

1,126,842. Electrical Appliance. R. H. Olley, assignor to Crouse-Hinds Co., Syracuse, N. Y.. Rotary switch and fuses are mounted on insulating base provided with skirted cover.

1,126,877. Vapor Alternating-Current Rectifier and Similar Apparatus. B. Schaefer, assignor to Hartmann & Braun A. G., Frankfort-on-the-Main, Germany. A hood surrounds each anode and a shield

above the cathode receives the mouths of the hoods.

1,126,901. Illuminated Sign. W. F. Stack, Knoxville, Tenn. Box sign with single lamp inside and inwardly extending reflectors directing light from the lamp through the letter openings.

1,126,902. Safety Apparatus for Motion-Picture Machines. A. D. Standeford, Kansas City, Mo. Electropneumatically controlled shutter to cut off the light from the projector.

1,126,935. Electric Heater. C. M. Angell, assignor to Van Briggle Tile & Pottery Co., Colorado Springs, Colo. Disk stove with pottery body and refractory clay surface below which the element is imbedded.

1,126,951. Electric Switch. P. D. Bucknum, Oklahoma, Okla. Has U-shaped spring contact member with coiled central portion.

1,126,952. Semi-Mechanical Telephone System. A. M. Bullard, assignor to Western Electric Co. Has automatic distributer and connector switches.

1,126,956. Method of and Means for Equalizing the Potentials of Grounding Points. A. B. Clark, assignor to American Telephone & Telegraph Co. Consists in connecting grounds at separated stations and applying to the connection at one station potentials opposite in sign and varying as the differences in ground potentials.

1,126,958. Light Distributer. D. Crownfield, Cambridge, Mass. Semi-indirect fixture.

1,126,963. Semi-Automatic Telephone System. A. H. Dyson, assignor to Kellogg Switchboard & Supply Co., Chicago, Ill. Line selectors, impulse-sender selectors and first selectors are permanently associated in groups of three.

1,126,966. Sending Mechanism for Electromagnetic Waves. R. A. Fessenden, assignor to M. Kintner, Pittsburgh, Pa., and H. M. Barrett, Bloomfield, N. J. Includes

No. 1,127,106.—Multiple-Fuse Plug.

a typewriter and simultaneously operating code commutator, a resistance, a short-circuit around it, an electromagnetic circuit-closer for closing this circuit and controlled by the commutator.

1,126,974. Spark Plug. F. M. Furber, assignor to A. R. Mosler, New York, N. Y. Soft-metal bushing between insulator and shell forms a gas-tight joint.

1,126,975. Art of Manufacturing Spark Plugs. F. M. Furber, assignor to A. R. Mosler. Details of manufacture.

1,126,985. Push-Button Switch. A. W. Gray, assignor to D. E. Bown, Pittsburgh, Pa. Relates to mechanism of wall switch.

1,126,986. Scaffold-Hanger. O. A. Green, New York, N. Y.; K. Green, executrix of said O. A. Green, deceased. Motor-driven scaffold and platform-raising means electrically controlled from the scaffold.

1,126,988. Electric Switch Mechanism. J. F. Grohowsky, Fortyfort, Pa., assignor of four-tenths to J. J. Murray. Solenoid-actuated track switch.

1,126,989. Trolley Contact. J. F. Grohowsky, Kingston, Pa. Contactor actuated by trolley wheel and controlling track switch.

1,127,005. Telephone System. C. L. Howk, assignor to Western Electric Co. For trains; has an exchange on each car for interconnection between cars and connection to outside lines.

1,127,008. Elevator Signal System. C. S. Johnson, Dallas, Tex. Lamp signals controlled by push-buttons at each floor.

1,127,017. High-Frequency Therapeutical Apparatus. F. M. Kidder and M. H. Kidder, New York, N. Y. Comprises a handle, an electrode and a flexible protector for the connecting cord.

1,127,021. Incubator. R. Klett, New York, N. Y., assignor to Kny-Scheerer Co. Quick-heating electric incubator with a network of resistance wire, an electric lamp for illuminating the incubating chamber and a thermostatic controller.

1,127,025. Process for Producing Perforated Tubular Electrodes for Accumulators. J. Krannichfeldt, Cologne-Niehl, Germany. The openings in the tubes are covered with paper on the inside, the tubes are filled with active material and after the latter has hardened the paper is destroyed by filling the battery with strong acid.

1,127,042. Manufacture of High-Potential Porcelain and Glass Insulators. F. M. Locke, Victor, N. Y. Formed entirely of a composition including a boron compound, molded and fired.

1,127,043. Electric-Arc Extinguisher. F. M. Locke. One extremity of horn gap carries an explosive cartridge.

1,127,044. Insulator. F. M. Locke. Formed of a composition body comprising a silica base and a boron compound fused together into a homogeneous body.

1,127,050. Impulse-Sending Mechanism. F. R. McBerty and A. H. Adams, assignors to Western Electric Co. Calling dial device for automatic telephone.

1,127,062. Reflector. D. J. O'Brien, San Francisco, Cal., assignor to Straight Filament Lamp Co. For tubular electric lamps; has segmental casing with narrow rectangular reflecting surfaces arranged longitudinally edge to edge.

1,127,083. Telautographic Apparatus. H. W. O'Neill, assignor to Gray National Telautograph Co., New York, N. Y. Includes electromagnetic pen-moving parts, a pair of condensers and a short-circuiting buzzer group.

1,127,084. Water-Level Indicator. J. J. Ogilvie and F. F. Dier, Ottawa, Ont., Canada. Electric lamps on a column and a similar set remotely placed act simultaneously as the level changes.

1,127,088. Panelboard Receptacle. D. Platt, Bridgeport, Conn. For Edison plug fuse.

1,127,103. Automobile Signal. E. Soulé, New York, N. Y., assignor of one-half to E. Buff. Solenoid-operated direction-indicating semaphores.

1,127,106. Multiple-Fuse Plug. E. Etrazinsky, Philadelphia, Pa. Two-part Edison plug with a set of fuse elements in the cap, successively thrown into circuit by rotation of the cap. (See cut.)

1,127,119. Oil Switch. H. L. Van Valkenburg, assignor to Allis-Chalmers Mfg. Co., Milwaukee, Wis. High-potential switch for mounting back of board.

1,127,123. Driving Mechanism. G. R. Walker, Chicago, Ill. Electric vehicle driving set with motor inclosed about axle and gear-connected to drive wheels.

1,127,158. Dynamo-Electric Machine. V. G. Apple, assignor to Apple Electric Co., Dayton, O. Inclosed machine for automobile starting or lighting.

1,127,161. Head-Band for Telephone Receivers. N. Baldwin, Mill Creek, Utah. Holds receiver to each ear.

1,127,162 and 1,127,163. Method of Treating Mill-Scale. F. M. Becket, assignor to Electro Metallurgical Co., Niagara Falls, N. Y. Tungsten is extracted by reducing process, the final stage of which occurs in an electric furnace.

1,127,177. Method of Producing Railway Rails. H. P. Brown, Montclair, N. J. Method of increasing the life of rails consists in simultaneously electrically producing manganese steel and welding it to the surface of the rail.

1,127,178. Recording Lock. H. W. Brown, assignor to J. G. Trainer, Chicago, Ill. Electrically records each operation of lock.

1,127,185. Controlling System. H. W. Cheney, assignor to Allis-Chalmers Mfg. Co. Manual and automatic control of rotor resistance of induction motor provided with flywheel.

1,127,193. Electrical Signaling Apparatus. W. T. Craft, Denver, Colo. Crossing signal controlled by contact along trolley wire.

1,127,197. Ignition Apparatus for Automobiles and the Like. R. H. Cunningham, New York, N. Y. Special induction-coil arrangement.

1,127,199. Signal. C. O. Harrington, assignor to Union Switch & Signal Co. Special signal lens for use with electric incandescent lamps.

1,127,217. Electric-Railway System. O. E. Falch, Jr., Mill Valley, Cal. Two parallel sets of flexible current collectors mounted on the top of and extending the entire length of the train.

1,127,263. Starting Device for Alternating and Three-Phase Current Motors. M. Kallmann; P. Kallmann, Berlin, Germany, administratrix of said M. Kallman, deceased. The rotor resistance is increased when the stator circuit is reversed.

1,127,280. Resistance Element and Process of Making Same. R. H. Read, assignor to General Electric Co. Resistance wire surrounded by a layer of asbestos about which is a metallic sheath.

1,127,281. Resistance Wire for Electric Heaters. R. H. Read, assignor to General Electric Co. Between the wire and its outer metal sheath is powder refractory insulating material.

1,127,290. Variable-Frequency Commutator Machine. A. Scherbius, Baden, Switzerland. Frequency and voltage are variable.

1,127,326. Weatherproof Cap and Shell for Incandescent Electric Lamps. A. Vetter, Pittsburgh, Pa. Notches and conical abutment to hold porcelain inner body from moving. (See cut.)

1,127,330. Spark Plug. J. G. Westbrook, Ogdensourg, N. Y. Details of construction.

1,127,356. Safety Device for Punch-Presses. E. L. Gale, Sr., assignor to Otis Elevator Co., Jersey City, N. J. An electric switch must be held by each hand of operator in safe position to keep machine in operation.

1,127,364. Furnace Hoist. D. Larson, assignor to Otis Elevator Co., Jersey City, N. J. A manual switch effects starting of motor in one direction and automatically operated switches controlled by dashpot effect reversal of motor.

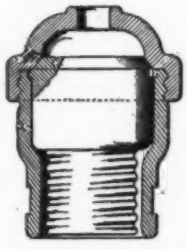
1,127,368. Interference Preventer. T. B. Miller, assignor of one-half to Smith Cannery Machines Co. Wireless receiving apparatus with two detectors connected between two transformers.

1,127,371. Apparatus for Amplifying or Detecting Electrical Variations. G. W. Pierce, Cambridge, Mass. An ionized evacuated vessel used as radio detector.

1,127,373 and 1,127,374. Electric Heater. R. H. Read, assignor to General Electric Co. Metal-armored heating element is employed that is referred to in Nos. 1,127,280 and 1,127,281.

1,127,375. Electric Time Switch. J. H. Robertson, Plattsville, Wis. For periodically controlling a motor-driven machine.

1,127,379. Electric Switch. C. A. Bates, assignor to Perkins Electric Switch Mfg.



No. 1,127,326.—Weatherproof Socket.

Co., Bridgeport, Conn. Four-point rotary switch.

Patents Expired.

The following United States electrical patents expired on February 8, 1915:

598,498. Junction Box for Electric Conductors. T. J. Close, Philadelphia, Pa.

598,508. Automatic Electric Fire-Alarm. W. A. Guthrie, Durham, N. C.

598,517. Testing Apparatus for Electric Currents. E. Heymann and F. W. Heymann, Boston, Mass.

598,540. Construction of Dynamo-Electric Machines. A. Soames, London, England.

598,553. Electric Switch. J. M. Anderson, Boston, Mass.

598,556. Primary Battery Cell. F. H. Brown, Chicago, Ill.

598,568. Method of Manufacturing Rheostates, Electric Heaters, Etc. H. W. Leonard, New York, N. Y.

598,580. Trolley Head. H. W. Smith, Somerville, Mass.

598,610. Coin-Controlled Telephone Pay Station. W. Gray, Hartford, Conn.

598,638 and 598,639. Electric Heater. J. F. McElroy, Albany, N. Y.

598,655. Coin-Controlled Machine for Automatically Distributing Electric Currents. J. W. Dawson, Louisville, Ky.

598,657. Alternating-Current Dynamo. W. B. Esson, London, England.

598,679. Means for Use in Operating Electrical Switches. T. H. Parker, Tettenhall, England.

598,697. Electric Arc Lamp. S. I. Crain, Cincinnati, O.

598,715. Automatic Electric Switch. F. C. Perkins and J. D. Killip, Buffalo, N. Y.

598,726. Incandescent Electric Lamp and Process of Making Same. J. C. Fish, Shelby, O.

598,731. Electric Railway. M. T. A. Kurbursckky, Berlin, Germany.

598,733. Safety Cutout for Electric Lamps. A. N. Lovelace, Knoxville, Tenn.

598,853. Electric Call-Box System. W. T. Budds, Charleston, S. C.

598,864. Electric Time Switch. G. F. Goodwyn, Armprior, Canada.